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EXPLANATORY NOTE

Illustrated articles are .... e with an asterisk (•). New shop equipment as described in the departments "Shop Equipment News" and "Condensed Clipping Index of Equipment" with a double dagger (‡). Cross references to a particular initial work may apply also to its derivatives. The cross references condense the matter and assist the reader but are not to be regarded as complete or conclusive. So, if there were a reference from "Milling" to "Jigs and Fixtures," and if the searcher failed to find the required article under the latter topic, he should look through the "Milling" entries, or others that the subject might suggest, as he would have done had there been no cross reference. The plural of any given item may not necessarily follow the singular immediately, as the items are listed in alphabetical order. All articles written by any given author are listed directly under his name in the special author's index which starts on page 13. Articles that are not credited to any author may be found under the heading "No author," listed under "N" in the Author's Index.

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NEWS SECTION

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Salvage and Repair of Railroad Equipment

Salvage of Material Formerly Sold as Scrap—An Air Hammer of Novel Construction A Portable Lathe—Handling Car Wheels

By S. ASHTON HAND
Associate Editor, *American Machinist*

RAILROADS in their present fight to make ends meet are practising economies not heretofore thought of. That old material formerly sold as scrap is now being salvaged and again put into serviceable use is evidenced by what may be seen in the railroad repair shops in almost every locality.

On the Atlantic Coast Line Railway, the tin roofs on freight cars, when damaged either by rust or accident, are stripped from the cars and sent to the shops, where they are first straightened. Then the damaged parts are cut from the sheets and new pieces inserted and fastened by lock seaming.

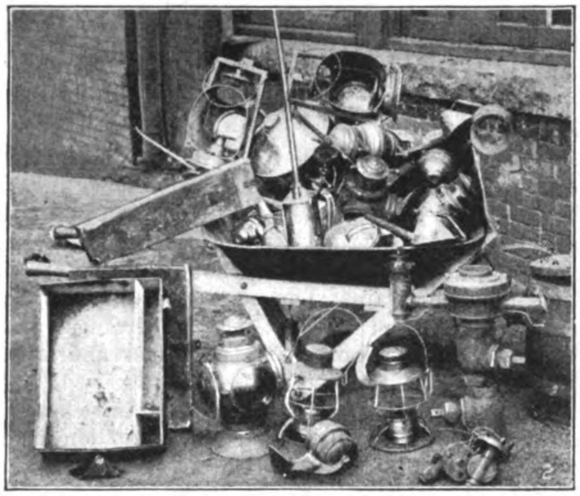


FIG. 1—A PILE OF DAMAGED CAR ROOFS. FIG. 2—LANTERNS, OIL CANS, ETC., THAT WILL BE SALVAGED

Some of the damaged car roofs on the Atlantic Coast Line are shown in Fig. 1 piled up at the Waycross, Ga., shops, where they have been shipped from all parts of the system. Here they will be reconditioned, again to do duty. The average cost of repairing these roofs is $6.40 each and as a new roof costs from $50 to $60, the saving is quite considerable.

A lot of damaged lanterns, car lamps, rear-end signal lamps, switch lamps, oil cans, etc., are shown in Fig. 2, and will all be put in serviceable condition at an average cost of about 45 cents each.

Round rods from worn out or broken ventilating doors of freight cars, from brake rigging and various other parts of rolling stock anatomy were salvaged at these shops in March, 1922, to the amount of 51,547 pounds.

The dining-car stove in Fig. 3 is undergoing thorough repairs, including a new lining of asbestos and the insertion of some new sheets. Formerly this stove would have been scrapped.

Waste taken from the journal boxes of passenger cars is brought to the press shown in Fig. 4 and the oil pressed out of it. The waste is packed in the receptacle at *A*, to which a piston is fitted. Pressure on the piston, supplied by air in the cylinder *B* (which by the way is an old air-brake cylinder) is sufficient to squeeze as much oil out of the waste as can be done by such a method. The waste is then taken from the press and put in a tumbling barrel made of wire mesh, contained in the tank *A*, Fig. 5, where it is immersed in water kept at the boiling point by the introduction of steam. Here the tumbling barrel is revolved, sloshing the waste in the water for 10 or 15 minutes to remove the balance of the oil, after which it is removed and put in the centrifugal separator *B* and the water taken from it. The reclaimed waste and oil are used for packing the journals of freight cars.

It may be wondered if the salvage of materials referred to actually pays, but when consideration is given to the fact that the majority of the work is done in

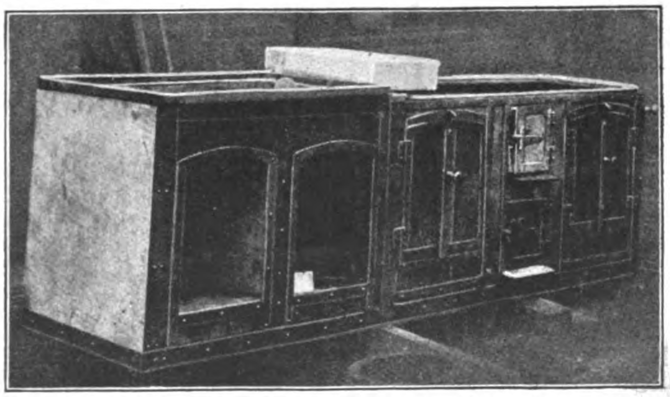


FIG. 3—A DINING CAR STOVE UNDERGOING REPAIRS

spare time by help that must be paid, whether employed full time or not, it will be conceded that considerable saving has been attained. The air hammer for straightening rods shown in Fig. 6 is made from an 8 x 12-in. air-brake cylinder having the usual non-pressure head and internal spring. A square piston rod has been fitted to it to prevent the die attached to the piston rod from turning, this arrangement being much simpler and cheaper than making guides for the die to travel in. A series of ⅜-in. holes drilled around the center of the cylinder at *A* allows air to escape when the piston has passed them on the downward stroke. When striking and compressing the spring, the piston is shot upward until the air sends it down again. Thus a very rapid reciprocating motion is secured without any reversing valve, and the greater the air pressure the longer and harder the stroke.

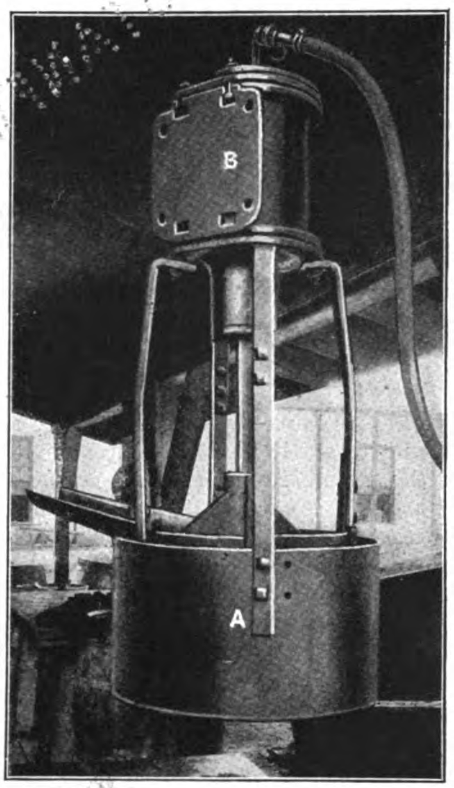


FIG. 4—PRESSING OIL OUT OF JOURNAL-BOX WASTE

Staybolts in locomotive fire boxes have small holes known as tell-tale holes drilled in them longitudinally, so that should a staybolt break, the break will announce itself by the leak of water or steam.

A machine for drilling tell-tale holes is shown in

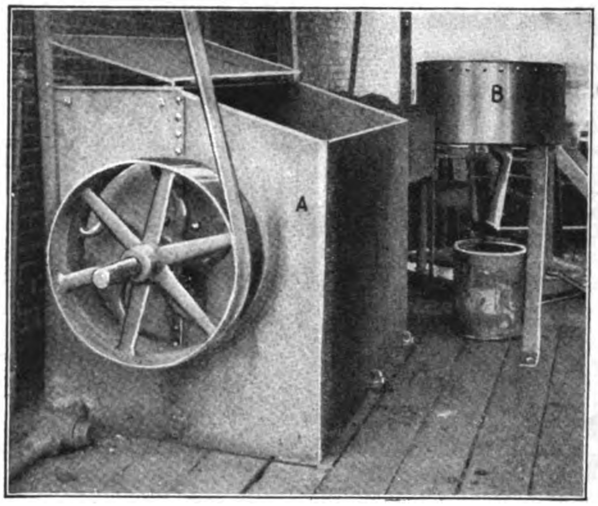
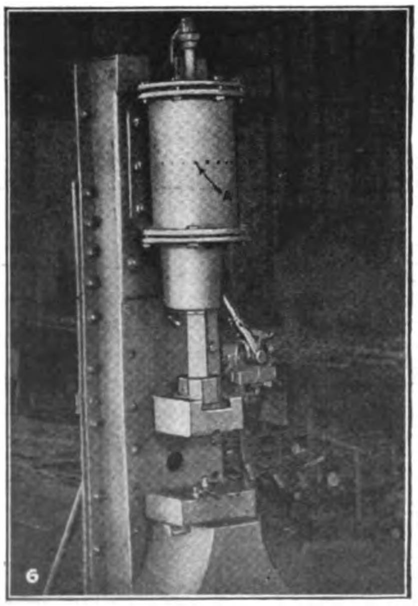
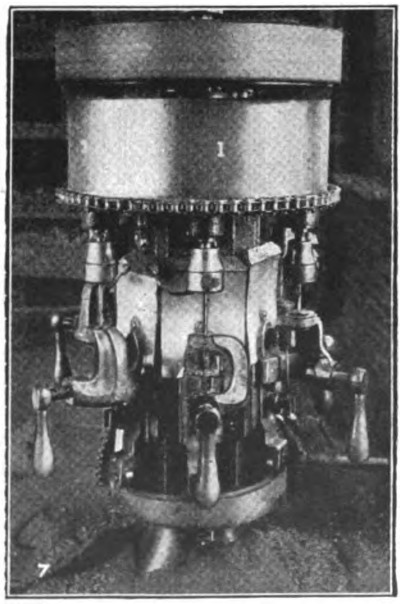


FIG. 5—WASHING AND DRYING JOURNAL-BOX WASTE

Fig. 7, in which stations and fixtures are provided for six bolts around a central column. The bolts are held in V-blocks as at *A* and *B*, Fig. 8, and the drills are guided by bushings as at *C*. The fixtures are mounted on vertical slides, each having a roller bearing on the cam *D* below. In operation, all stations revolve around the central column and are pushed upward by the stationary cam *D* as they revolve, bringing the end of the bolt against the drill. It will be understood that the depth of the hole drilled is controlled by the height of the rise on the cam. When the roller attached to a slide reaches the low part of the cam at *E*, drilling of the bolt in that station is completed, and it can be taken out and replaced by another. It will be seen that the cam has a rise and fall at *G* which allows the slide to fall and then rise again before the drilling has been completed. There are several such places in the cam, and their purpose is to allow the slides to drop down at stated intervals so as to bring the bolts below the drill and clear the holes from chips.

In delivering car wheels after they are bored, they are lowered by the crane attached to the boring mill so that one edge strikes the top of the iron tripod shown in Fig. 9. Further lowering tilts the wheel so





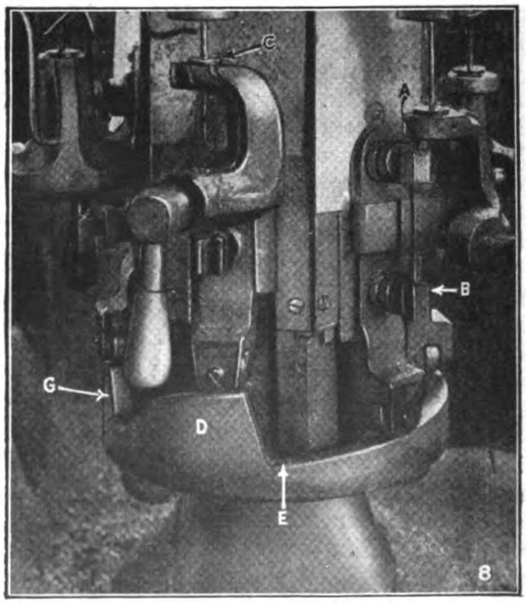
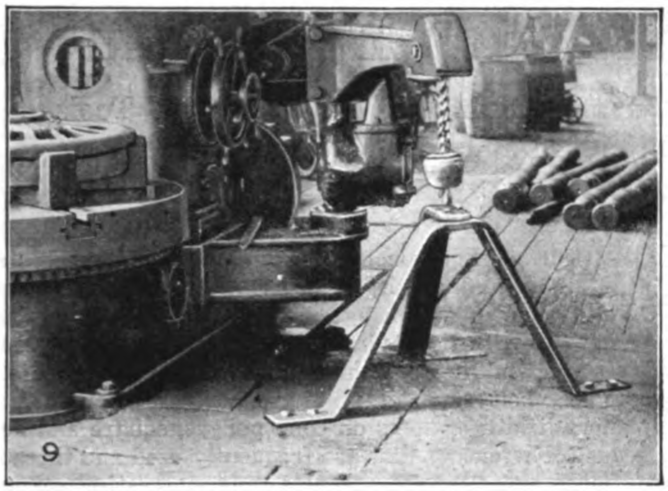
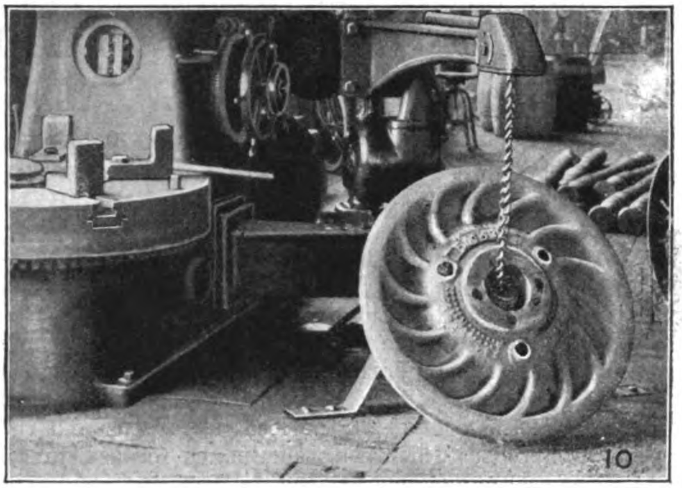


FIG. 6—A HOME-MADE AIR HAMMER. FIG. 7—MACHINE FOR DRILLING STAYBOLTS. FIG. 8—CLAMPING FIXTURES AND CAM OF STAYBOLT DRILLING MACHINE





FIGS. 9 AND 10—HANDLING CAR WHEELS AT THE BORING MILL

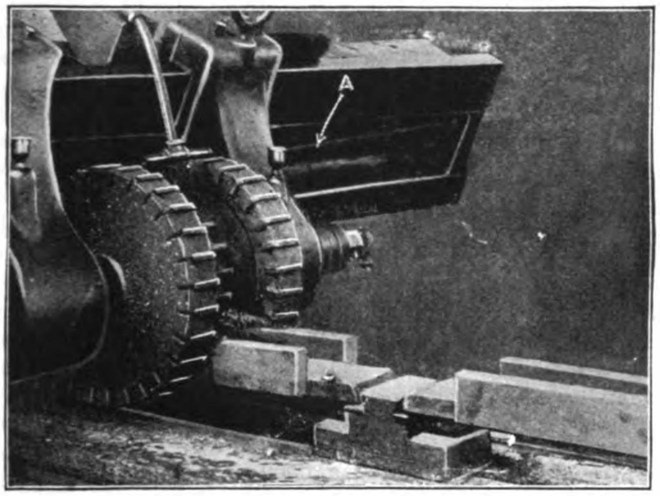


FIG. 11—MILLING SHOES AND WEDGES

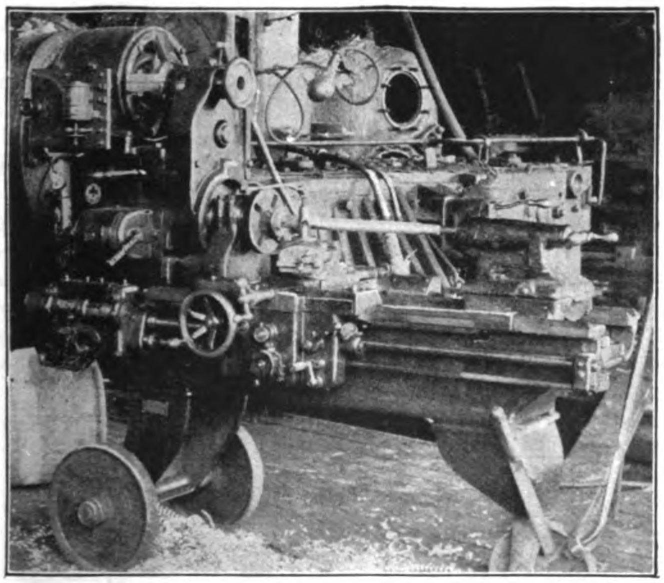


FIG. 12—A PORTABLE LATHE

that when the flange touches the floor, the wheel is an almost vertical position as in Fig. 10, and can be readily rolled away. Wheels to be bored are rolled up to the tripod and rested against it. From that position it is an easy matter to attach the crane chain and hoist them up and deliver them to the boring mill table.

Shoes and wedges are set up in a string on an Ingersoll planer-type milling machine, as shown in Fig. 11, and the three inside and two of the outside surfaces finished by a gang of cutters at one setting. This method leaves the bearing surface only to be finished in another operation.

The result of having to use "McAdoo mechanics" during the war is shown in the badly bent feed screw in the cross rail at *A*. The damage was done by allowing the head to come against an obstruction while being traversed by power.

It is getting to be general practice to have one or more portable lathes in the erecting shop and to place them directly beside the engine being worked on. Fig. 12 shows a motor-driven LeBlond lathe mounted on wheels so that it can be easily transported to any part of the shop. Such lathes are a great convenience since, among other lathe jobs, there are many taper bolts to be turned and fitted to place in overhauling an engine, and to carry them to and from the shop to the engine several times between cuts to try the fit is a tedious process. Also much other work can be more conveniently done if the lathe is close to the work.

Balanced Equipment

By Robert Grimshaw

Just as a chain is no stronger than its weakest link, few plants have any greater capacity or efficiency (please note the difference between "capacity" and "efficiency," because there is a wide gulf fixed between them) than is permitted by the least productive machine or the one with the least output.

In a properly equipped manufacturing plant, each production center should be able to take care of all the work from that preceding it and keep the next one exactly and profitably busy. We find this balanced condition infrequently and particularly seldom in small plants, or rather in those where each process or operation is performed on but one or two machines. In consequence, the idle time account of some machines or production centers is excessive.

In a tour embracing about forty manufacturing plants in this country, I found but one in which there was perfect balance. In this case there were large groups of machines for each operation or process. It is easy to see that, if six machines of one kind cannot take care of the output of five or the kind preceding, another may be added much more efficiently and economically than where one of a sort cannot handle the product of the one back of it.

Standardizing Machine Shop Equipment

Advantages Which Justify the Cost—A Successful Method of Improving Old Tools—Tapers Reduced to One Standard and Two Sizes

BY H. L. WHEELER

IT IS pleasing to note that the subject of standardization is now receiving some favorable consideration which is based upon a desire to establish better conditions in commerce and industry. As an example of the need for standardization, I recall a disastrous fire some years ago in a neighboring town. The fire got beyond the control of the local apparatus and the near-by city department was summoned for assistance. After several pumps had arrived on the scene, ready for business with a full head of steam, it was discovered that the hose connections would "not go." The fire could not be extinguished, and a quarter of a million dollars in property went up in smoke. Since then I have given much thought to the subject of standardization. Figuratively, this fire is an example of what goes on in business and in industry every day in the year through the lack of standardized conditions and methods, and I would not hazard a guess as to the probable amount of money lost in this way.

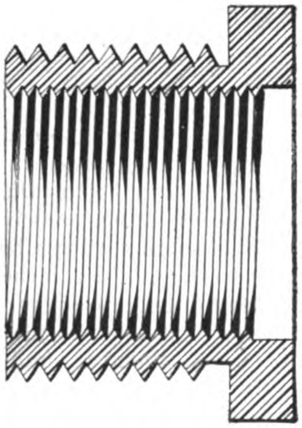


FIG. 1—CHUCK ADAPTER FOR SMALL LATHE

In machine shops long established and still using equipment built in the last forty years, for there are many such, numerous details of machines and equipment may be standardized with profit to the shop. This sometimes involves a change of method in doing certain jobs, rebuilding machines or making over certain details of them to make them more efficient or up to date. It has been fully realized that a great disparity prevails in the details of machines and equipment, which necessitates surplus effort and expense, and occasionally results in a general demoralization.

It is with the object in view of bringing about greatly improved conditions and of making the practices of the industry more economical and universal, that standardized conditions should prevail in the shop. Standardizing equipment is quite distinct from activities along similar lines in other fields, but the fundamental principles are the same. So many advantages are to be derived from standardization, that the cost of making the necessary changes is of secondary consideration. Perhaps a limit should be set on the amount of money to be spent for such work. From the writer's experience, an amount equal to 25 per cent of the original cost of the machine is not too high a figure, providing of course that the results to be obtained are sufficiently promising. Good judgment and plain horse sense, however, should be the guide in this undertaking.

It is sometimes necessary to make radical changes and to eliminate a list of items which have long been looked upon as indispensible. The first step in this work should be to make a careful study and survey of the equipment and conditions, and to collect data.

In the average machine shop are found machines, small tools and sundry equipment of many different makes, none of which agree in important details that have to do with the saving of time and money. Tapered holes in milling machines, lathes and drill-press spindles, bolt slots in milling machines, shapers and planers, width of steps on cone pulleys, square and hex heads for wrenches that are frequently used and threads on lathe spindles, are a few details suggesting others.

Several different tapers in a shop are a constant source of annoyance and needless expense when one standard taper would serve all practical purposes. This standard would eliminate many bent arbors, broken drills and centers, ruined drill chucks and burred and cut spindle holes, would save much time now wasted, and would appreciably reduce the small tool expense. Here in one item alone, standardization would save ten times its cost every year.

It may not be possible to induce the machine builders to adopt a standard taper and other standard details, but the individual shop can have a standard of its own. The work of making the necessary changes can in most cases be done right in the shop. Some ideas and a method of standardizing equipment successfully employed by the writer, may be of use to others.

After a survey of the machines, tools and other equipment was made, a special shop order was issued, to which all labor and material connected with the work were charged. The next step was the selection of a man who was considered capable of carrying out the work to its completion. The whole situation was gone over with the man selected, who was an excellent mechanic, and the object in view was explained to him. He was allowed a free hand and was instructed to use his own head. One machine at a time was standardized and repaired where needed, so that the work did not interfere with the regular production.

As most of the lathes in this shop were of an old model with solid spindles, some hollow spindles were designed by the writer to take their places. As the chucks had seen many years of service, they were not considered worth repairing, and so were replaced by new chucks. The threaded ends of the old spindles were

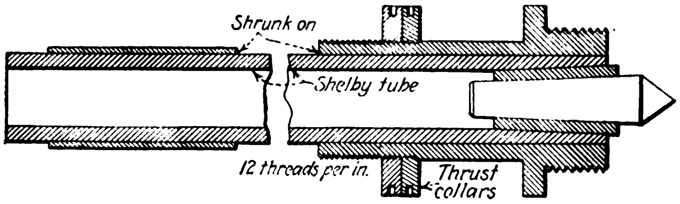


FIG. 2—HOLLOW SPINDLE DESIGNED TO REPLACE SOLID ONE

of small diameter, and would not support the heavier chucks in use today. In designing the new spindles it was possible to use the same thread on the spindle noses for lathes of the same size, and so to make all chucks and faceplates interchangeable. As the chucks were seldom all in use at one time, by this arrangement, three chucks were amply sufficient to serve six 18-in.

lathes, and one chuck served both the 20- and the 24-in. lathes. Two sizes of chucks were purchased for the 18-in. lathes and by using an adapter, shown in Fig. 1, the smaller chuck was made available for a 12-in. lathe.

For one lathe, an 18-in. Putnam, a little more modern than the others, a special spindle was designed, as shown in Fig. 2, and was fitted with a set of new Hendey spring chucks. This feature became a great favorite with the men for getting out small orders of special screws, studs and other round parts made from bar stock. Under the old order, this class of work had to be cut off, centered and turned between centers on account of the solid spindles.

In making the hollow spindles, Shelby steel tubing was used. This material can be purchased in a variety of sizes and will give excellent results. It also eliminates the expensive operation of deep hole drilling, something that every shop is not equipped to do. For the taper hole, the Morse standard was adopted. Two sizes, Nos. 2 and 4 were all that were needed for our work. In some shops, three or more sizes may be required. Two tapered gages and two tapered finishing reamers of corresponding sizes were purchased for this work, which should be carefully done to the correct standard gage. Otherwise, serious trouble will develop in the interchange of tools. Centers were made all of one size, except for one 8-in. lathe which required a special center.

Odd Screw and Wrench Sizes Eliminated

The work of changing the spindles of drill presses and milling machines is practically the same as that described for lathes. There were three drill presses in this shop, and each had a different taper. This condition required the use of different sized adapters, and chuck shanks.

If a man desired to use a drill chuck in a lathe or in some other machine for which the shank was not fitted, he would have to drive out one shank and put in another. Often a new man, not on to the "ropes," would endeavor to use a chuck or the wrong adapter in some machine for which it was not intended. Occasionally, he would get away with the job by packing the adapter with paper or by some other slip-shod method. With this practice, for years such tools were always in a bad state of repair and many were on the sick list a good part of the time. Manifestly, the ideal condition is to have a single standard taper in two or three sizes.

Square and hex heads on setscrews, bolts, nuts, toolpost screws and vise screws that are frequently used in making adjustments, setting up and operating a machine, may be standardized and many odd sizes may be eliminated. In the case of milling machine vise handles, for instance, a common size can be used so that the handles will be interchangeable on vises of different makes.

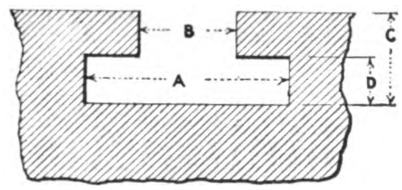
Standardization is also an advantage in toolpost binding screws and in many other places. Frequently a vise handle or toolpost wrench is mislaid and cannot be found at the exact moment it is needed; or perhaps some one has borrowed it and will not bring it back until he is finished with it. But if he can turn right around and use the handle or wrench on the next machine, how much more time he will save than if he wastes 10 or 15 minutes in hunting for a wrench and finally is forced to use a monkey wrench.

A feature about binding screws, of which many mechanics are ignorant, is the chance of straining the screw by using too large a wrench. This is what often occurs to milling-machine vise screws and toolpost binding screws, when a heavy monkey wrench is used in place of the right wrench that cannot be found.

Reducing the Variety of Bolt Slot Sizes

Bolt slots in machines should also be developed to a minimum number of sizes, so as to reduce the variety of sizes required to serve all machines, and to thereby reduce the time lost in looking for bolts in setting up a machine. A standard may be arrived at after comparing the sizes of the slots in the several machines to be changed. In a group of several planers, milling machines or shapers of approximately the same size a single bolt slot size may be possible.

Milling out the slots to the desired size is a simple operation. An example of this procedure is illustrated in Fig. 3, which gives the details of a slot for four different machines. The data for standardizing this group of slots are shown in the accompanying table. It will be apparent from this arrangement, that one sized bolt will serve the four machines, whereas before, four sizes were required and three out of every five bolts were always unserviceable. This method may be followed for any number of machines in one group.



	1	2	3	4	Std.
A	1 1/16	1 1/8	1 1/8	1 1/8	1 1/8
B	13/16	11/16	7/8	11/16	7/8
C	1	1 1/16	1 1/32	1 3/16	1 3/16
D	7/16	9/16	17/32	1/2	......

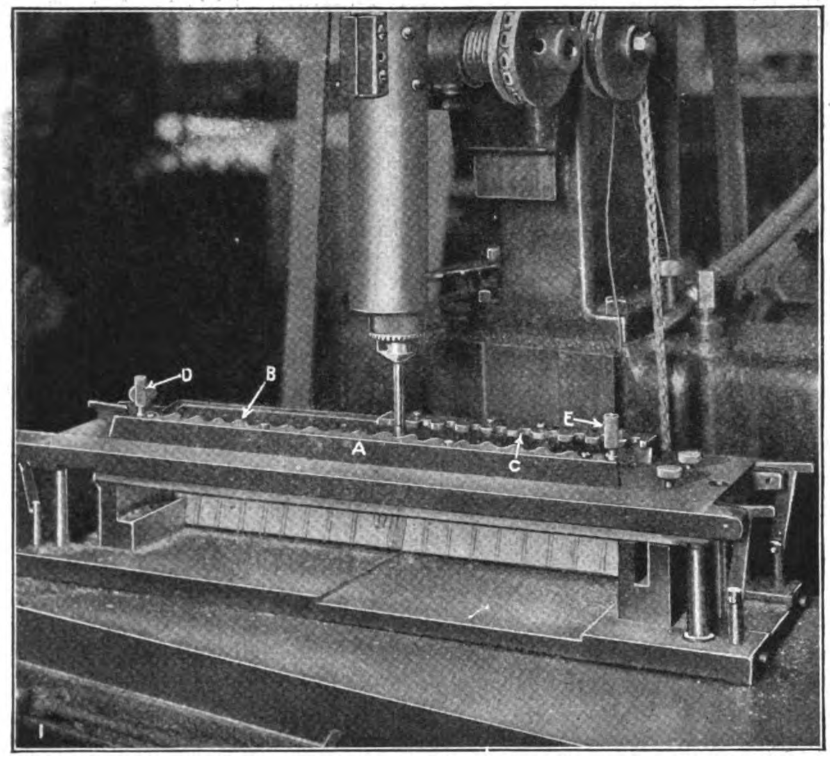
FIG. 3—DETAILS AND SIZES OF BOLT SLOTS FOR FOUR DIFFERENT MACHINES

Many machine-shop managers are skeptical as to the value of making the changes which have been outlined. The changes are small details in themselves and are seldom considered worth changing, although the average shop is required to support many items of expense which might easily be reduced by one-half through the simple process of standardization. The popular excuses for maintaining these conditions are the lack of time and the expense of making the necessary changes.

No matter how busy your shop may be, if you haven't got the time, take it and standardize every possible detail of machinery, tools and equipment. In the purchase of new equipment, it is well to consider the details that conform to the standard adopted, or the details that can be changed with the least expense.

The field of standardization offers many opportunities for saving both time and money in every machine shop, regardless of the size or the nature of the business. Does it pay? Yes, absolutely, it pays in dollars and cents right from the start and is a permanent improvement. It is a divided-paying business proposition, and deserves just as much attention from machine shop proprietors as standardization receives in other lines.

Perhaps in no other kind of business is there a greater lack of standardized conditions than in the average machine shop. Conditions, traditions and environment stand in the way of many improvements and standardization, particularly in small details.



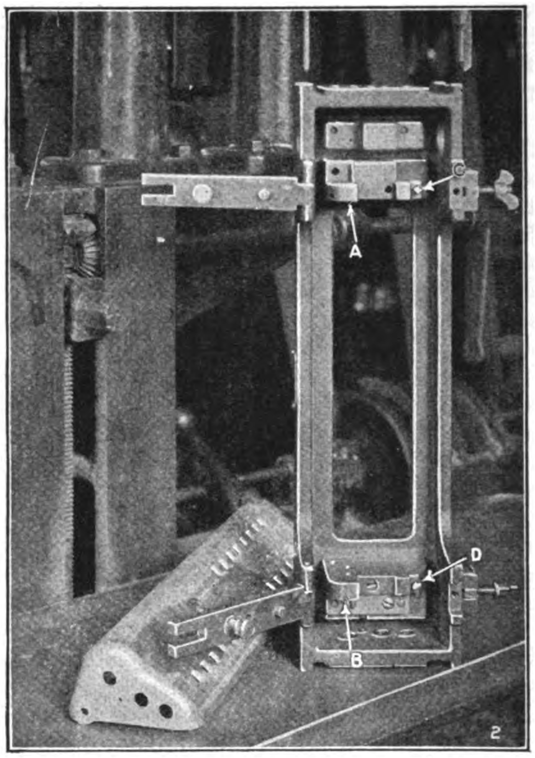


FIG. 1—MILLING WINDOWS IN COVER. FIG. 2—DRILLING THE END HOLES

Machining An Aluminum Carriage Cover

Die-Castings Used for Uniformity Rather Than for Elimination of Machine Work—Profiling, Drilling and Milling in Special Fixtures

BY FRED. H. COLVIN
Editor, *American Machinist*

IN ORDER to secure aluminum castings that are uniform and true to shape, the Monroe Calculating Machine Company, Orange, N. J., is utilizing die-castings as a starting point for its machining work. While on small work die-castings are used to eliminate machine work, this company has not found it advisable to do this in pieces as large as are required in the parts for its calculating machines, such as cases and covers. As castings, however, they work out very nicely, as they fit into jigs and fixtures remarkably well and are uniformly solid.

The piece shown herewith is a cover for the moving carriage and contains many windows through which the numbers show in reading the results of the calculations. There are several sizes, the largest cover being about 21 in. long.

After testing for straightness the cover is placed in the fixture shown in Fig. 1, where the windows are milled under a single-spindle vertical drilling machine. The holes are cast with a very thin web through which the milling cutter forces its way as the spindle is moved down into the milling position. The cover *A* of the fixture carries two serrated plates *B* and *C*, which guide the milling cutter in cutting out the windows as the whole fixture is moved along the drilling machine table. The top plate is held by four latches at the ends and is easily removable to change pieces.

The end holes are first milled and the hardened plugs *D* and *E* put into place to insure against possible movement of the piece in the fixture. Then the fixture is simply moved from window to window, being guided by the plates *B* and *C*. The plate *B* extends the whole length of the cover, while *C* is but half as long. Each hole is tested by an oval plug gage to insure uniformity.

The cover then goes to a multiple-spindle drilling machine as in Fig. 2, for drilling the end holes which support the shafts carrying the numbered wheels. This figure gives a good idea of the fixture and the way in which the cover is held. The curved blocks *A* and *B* fit up inside the cover and support it, while the edge rests on the pins *C* and *D*. The straps are held by the swinging bolts at the right, and each strap carries a clamping screw which bears on the high part of the cover holding it tightly against the curved blocks.

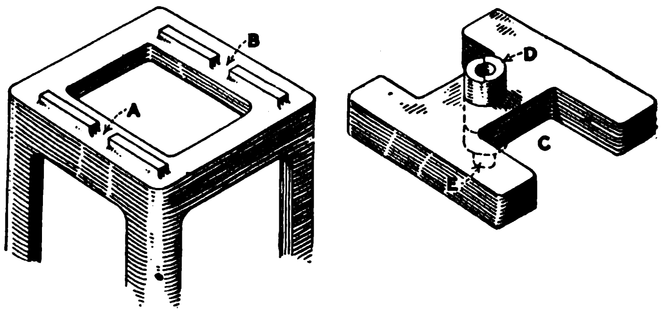
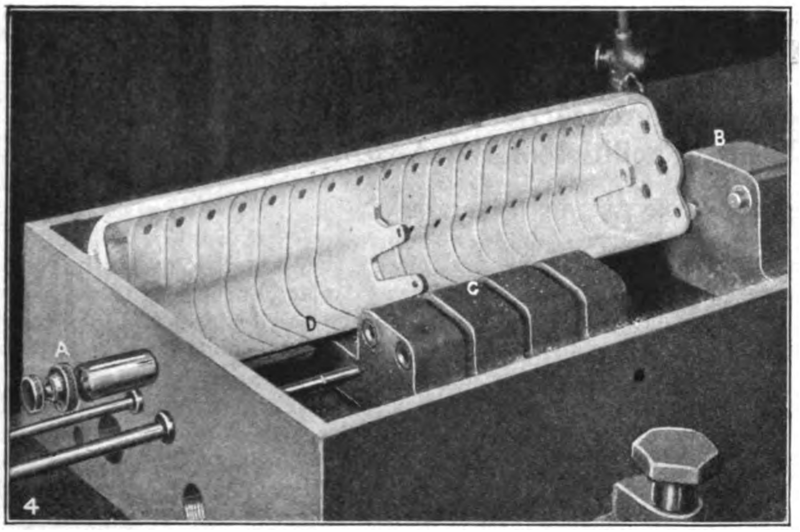


FIG. 3—GAGE FOR DEPTH OF COUNTERBORE



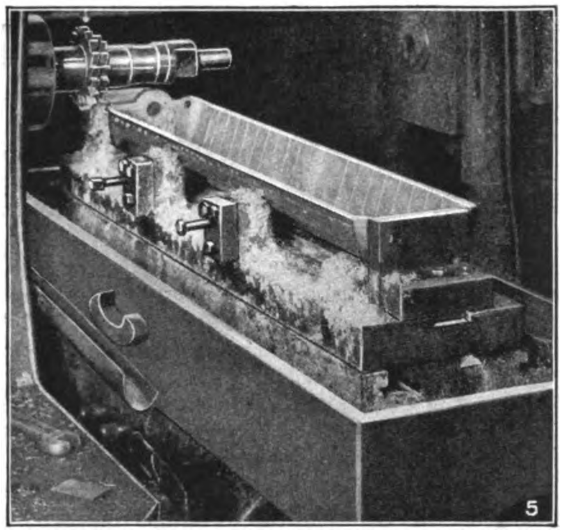


FIG. 4—DRILLING THE CENTRAL HOLE. FIG. 5—MILLING EDGE AND FACE OF COVER

Both ends of the fixture have raised feet which are surfaced both for drilling and for gaging the depth of the counterbore. This is shown in detail in Fig. 3, the raised feet being indicated at *A* and *B*. The gage shown at *C* rests on the feet and can be moved from hole to hole to see that they are all counterbored to the same depth. The flush pin gage at *D* tests the depth of counterbore, the lower portion of the plug at *E* being the gaging point that is brought to bear on the bottom of the hole.

The drilling of the holes in the central or supporting partition presented something of a problem, but it was solved by using a gun drilling lathe secured at a government sale. The fixture, shown in Fig. 4 accommodates three sizes of covers, the one shown being the shortest. The cover is positioned in the box-like fixture by pins which fit the end holes previously drilled. The pins are shown at *A* and *B*. Those at *B* are located in a block which can be moved inside the fixture itself, to accommodate the different lengths of covers.

The central block is fixed in position, but has three slots so positioned as to fit the different sizes of covers. This block is fitted with bushings which guide the drills *D* and insure accuracy in the alignment of the three holes which carry the wheel shafts. This operation requires considerable care on the part of the workman to be sure that no chips prevent the proper seating of the cover in the fixture, and to properly seat the guiding pins at each end of the cover. The results are very satisfactory, however, and the assembly goes along very smoothly when it is being done by a man who understands the work.

The final machining operation on the cover is milling the edge to insure proper seating when assembled on the machine. Here again the cover is located by the end holes, as shown in Fig. 5. It is carefully supported, both at the ends and at two other points, to avoid any springing of the casting under the milling cut, even though this is very light. The two cutters shown face both the edge and the side at one operation.

Filing Technical Articles

By Jasper H. Carlstrom

Many of the articles in the *American Machinist* are very useful to refer to in my work, especially those on tool engineering. As it would be inconvenient for me to carry the entire copies of the magazine to my work, I find it necessary to cut out those articles not likely to be of benefit to me. I usually allow the copies to accumulate a couple of months, and, having read them through, proceed by means of a sharp safety razor blade to remove those pages I want to keep.

The pages having been piled in their numerical order, the headings of the articles are then copied down with their corresponding page numbers on a piece of paper. The articles are now placed in manila paper envelopes, ten by twelve inches in size, preferably those whose flaps are fastened by a cord. It may be necessary to trim off the bottoms of the pages. The volume and page numbers are then marked on the envelope, as, for example, Vol. 56, pages 413-844.

I now proceed to make up the index as articles are classified into five divisions: Tool Engineering, Auto Tools and Methods, General Machine Work, Dies, Die Work and Small Tools, Theoretical and Miscellaneous Articles. The index is made up on sheets of typewriter paper about 5½ x 8½ in. in size by typewriting at the top the classification of the articles, followed by the headings of the articles with their corresponding page numbers. These are copied from the list already made up and checked from it as copied.

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By this means any article may be quickly found by referring to the classified index for the volume and page numbers which, as already stated, are marked on the envelope in which the article is filed. The index sheets are placed in a smaller envelope and this is kept in the latest large envelope to be filled. The material is always readily available and can be easily located by referring to the index and then finding the proper envelope.

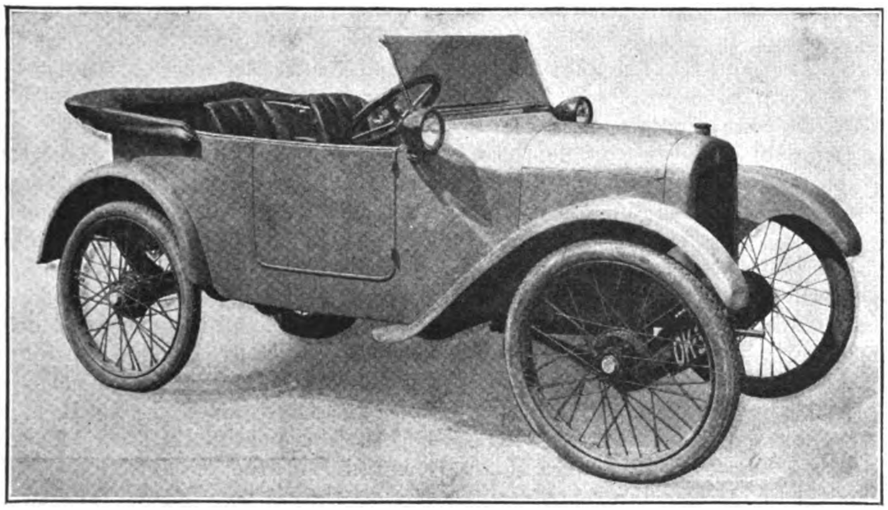
Mass Production in British Motor Industries

British Manufacturers Beginning to See Difference Between Mass and Standardized Production—Plans to Utilize Facilities of Big Austin Plant

BY HENRY OBERMEYER AND ARTHUR L. GREENE

"Mass production on the American model was the dream of several English automobile manufacturers not very long ago. Each felt that if he could get on the job first he could collar the market. That was a dream from which we woke up with a bang."

Thus the sales manager of the Austin Motor Company, Ltd., whose factory sprawls over the acreage of a fair-sized town just outside of Birmingham, England, and which company was one of the big concerns to feel the rocks as the result of over zealous productivity immediately after the war, is about to place on the market a new light pleasure car in competition with the popular priced automobiles of American manufacture. The details of the car and plans for its manufacture have only just been announced.



THE POPULAR-PRICED RUNABOUT RECENTLY ANNOUNCED BY AUSTIN

The war embarrassed many countries with certain kinds of "riches" whose peacetime utility was comparable to a white elephant. Many of these have not been properly liquidated or even disposed of yet. This condition, of course, was especially true of machine factories most of which found themselves, after almost superhuman activity, possessed of a suddenly idle army of workers and a hugely distended plant.

In England the inflated plants were a standing temptation. English manufacturers had long envied their American compeers the ability to do big things in a big way, to turn out by hundreds what they themselves sweated to produce by tens. They had the idea that American success in that direction lay in big organizations, in factories which were cities in themselves. Here at the British hand was just such an organization, born of necessity and obviously fitted for just one thing—quantity.

So, for a time, did the English dream come true. For two years following the war the chimneys belched their smoke and the hum of a tremendous activity throbbed through all the shops. A stream of cars sped from the factory to the outflung posts which were the agents. For a few months the agents had all they could do. It really did seem as if English motor manufacturing had gone through its revolution. Then, even more suddenly than it began, the boom ended. There was talk of bankruptcy. One or two actually did go under. The rest gasped and struck for shore.

Austin Motors believe they know the reason for the fiasco. "In the first place," they say, "we overestimated the market. In the second place, in our haste we sent out faulty products. In the third place, the idea was silly and should never have been seriously considered at all. The domestic market for cars at that time was fair, but only fair. The Colonial market, the great prop and staff of all English industries, was almost non-existent. Given something like a normal demand in the colonies, particularly Australia and New Zealand, the dream might not have been beyond the range of possibility. But here again the project caused so many complaints among car users who felt they had been cheated with an inferior product that the very shadow of a worldwide market was blotted out from the beginning. As a result of the situation mass production in England has received a shock from which it is never likely to recover. British manufacturers have learned what is to them the amazing truth that quantity and size are not, after all, the essential features of American industry. Say "mass production" to an Englishman today and he will pretend not to know what you're talking about. At best he will correct you to the use of "standardized production," thus proving that he has grasped the fundamentals of the problem.

"After all, you know, mass production is the result, isn't it?" they said in Birmingham. "It's the means that are important, and in this case they consist of the principle of duplication, the single-purpose machine, the die stamp. Duplication means not merely accuracy, but speed, interchangeability, and, most of all, economy."

This fairly obvious aphorism was expressed with all the wonder of a discovery. It is important, however, as indicating the lines on which certain British manufacturers of motor cars propose to work. The Austin Motor Company, Ltd., consider that they are now operating on a system of standardized production and Austin automobiles and engines are turned out by single-purpose machines. The parts are assembled by being swung into place, where they fit without a trial.

While the Austin Motor Company, Ltd., has spanned the gulf between individual production and standardized production, it has not thus far been wholly successful in educating the market to the advantages of the new method. It has been found necessary to maintain an entire shop solely for the construction of models of

special design, which are, it is true, in decreasing demand, but are still a very potent factor in automobile manufacturing abroad.

Henry Ford has estimated that in America only five per cent of the automobile buying public normally exhibit any preference for special variations to suit special tastes in the construction of their cars. The English public is still far from achieving such an ideal of uniformity. Many an Englishman regards his automobile in much the same way as his home. He wants it to express something of his personality. In addition there is the deeply ingrained prejudice against any system which seems to rob the workman of the traditional pride and interest in his product. England is a land of apprentices. A handmade watch or a handmade bit of lace may be inferior to the machinemade article, but it is more likely to command the Englishman's respect.

Thus, educating the market to a more pronounced faith in standardized production is the goal which Austin Motors, among others, has set for itself. In the fulfillment of this aim the Austin company is among the leaders. From motives of pure self defense it must be a leader if for no other reason than its tremendous facilities which, otherwise, would be like so many cancers eating up the profits of the business without making a return.

Mushroom Growth of the Austin Plant

For factories like the Austin plant the war was a modern Atlas which shifted the weight of armaments to the shoulders of the industrial Hercules without making provision for relief. The Austin Motor Company, Ltd., now occupies about fifty-three acres in the Longbridge section of Birmingham and is divided into three parts, known respectively as the South, West and North works. In 1914 only six of these acres, situated in a small corner of the South works, were used for manufacturing, in short, nearly a ninefold increase in only four years. The increase in personnel was proportionate.

During the early stages of the war, the Austin company was asked only to concentrate on transport and tank equipment, which required comparatively little alteration either of product or method. Armored cars, lorries, aeroplanes, aero engines and tractors were supplied in ever increasing quantities. But the original factory became inadequate for the growing demands of the Government. A call for guns and shells on a large scale developed. Not only were the old South works extended, but engineers hastily constructed a new factory on the west side for the specific production of 18-lb. shells, and still another plant to the north for the manufacture of 8-inch shells and 4.5 howitzer guns. This last, incidentally, is said to be one of the largest individual shops ever built. It is 900 feet long and was ready for work within six months after the first stone was laid.

Market Lags Behind Plant Capacity

Such is the gigantic machine which Sir Herbert Austin, founder and managing director of the company, has to his hand today. Imagine the producer of anything you choose starting off modestly on a small scale to supply a profitable but strictly limited market with his commodity. Imagine his astonishment and eventual dismay at finding that his plant has grown mushroom-like over night (kept pace with by overhead expenses) without either his volition or desire. Consider his panic at discovering that his market had not only failed to grow in proportion to his plant, but had actually contracted. Consider especially, as we do here, his attempts to deal with the situation.

It has been shown how Sir Herbert and some of his competitors began by what seemed at least the most obvious method, that of engaging in large scale production in apparent imitation of American firms. That stage has now passed, perhaps forever, into a fitful memory. But the factories are still there. There are, therefore, two roads open to the British manufacturer of automobiles. He can attempt by enterprising salesmanship to increase the market where it exists, or he can seek a new one. Here again, he can look abroad, although it is not unlikely that American competition will drive him out. He can even create a new market at home. In the latter case he is just as much an innovator as Henry Ford, who foresaw a popular demand for his car, not merely for pleasure but for business purposes and proceeded to supply the demand when other manufacturers were still concentrating on racing cars.

A New Light Car

We doubt if Sir Herbert Austin has any ambition to become the Henry Ford of the British Isles. Nevertheless, for the past two years he has been at work in his experimental shop on a new type of roadster which will, it is expected, combine the speed and durable qualities of more expensive cars with the cheapness and economy of operation of the motorcycle. Admittedly, this is a large order to fill. At any rate, the first three cars of the new type have left the factory and successfully passed all required tests. The great body of Austin agents, who were called in meeting for an announcement of the new car a few weeks ago, are said to be most enthusiastic and have shown their faith in the model by ordering up to capacity. The machines themselves will be in their hands in small quantities by fall and more widely, it is hoped, by the first of the new year.

Such a car, if at all successful, should have the advantage of a unique market in England which exists in America only as a reflection. For years, England with its splendid roads, its charming scenery, has been in a special sense a cycling nation. In America the bicycle was a fad which had its day and passed. In England the cycle is a necessity. Lately it has been superseded, in the case of those who can afford it, by the motorcycle. There may not actually be more motorcycles, especially sidecar combinations, on the roads than there are automobiles, but to the casual eye it would seem so.

Tremendous Market Assured

Here without doubt is a tremendous market for the man who can reach it. Ford has not done so. With transportation and duty charges, his car is still beyond the financial capacity of the motorcyclist. Such attempts as have been made to wean the motorcyclist from handlebars to the steering wheel have been largely makeshift, consisting of three-wheeled affairs with motorcycle engines or tiny roadsters at a cost only less than that of more serviceable machines. Sir Herbert in most particulars has tried to design "a car what is a car." His sales manager expresses it most succinctly. "We want to convince the purchaser that he really owns an automobile while charging him the price he would spend for the original cost and upkeep on a motorcycle."

In addition to the cyclist group, the Austin Motor Company, Ltd., also hopes to attract those two other vitally important classes, the woman driver and the commercial traveler. For reasons which will be apparent further on, no attempt is to be made now at the manufacture of light trucks from this type of car.

The appearance of the Austin "Seven," as it is called to distinguish it from the "Twelve" and "Twenty," is apparent from the picture. It has a four-cylinder water-cooled engine with a bore and stroke of 2⅛ and 3 inches respectively, capable of 7.2 hp. as rated by the R. A. C. Ignition is by high tension magneto controlled from the steering wheel. The seating capacity is for two persons and luggage or for five persons including three small children. A road clearance of nine inches is allowed.

Dimensions of Car

The dimensions of the car, over all, are 8 ft. 8 in. by 3 ft. 10 in., weighing 650 lbs. As a matter of actual road performance, the "Seven" has attained a speed of fifty-two miles per hour. Under perfect conditions it has achieved a consumption record of 78½ miles to the gallon, although fifty-five miles are said to result in normal operation. Complete running cost is estimated at 1¼d. per mile.

The new car, ready to ride, is to be put on the market at £225, or approximately £50 more than the best type of motorcycle combination. This is said to be only preliminary, however, a price settled on by the agents themselves, who agreed to take as many cars as the factory can turn out for many months. In time it is the expressed intention of the company to bring the price of the Austin "Seven" in more direct competition with that of the cycle combination, the manufacturers of which are themselves believed to be about to make substantial reductions.

Further operations of the Austin Motor Company, Ltd., will depend largely on the reception given to the new car. As requirements express themselves certain changes will undoubtedly be found necessary in the design. The wire wheels, for example, are approximately of motorcycle dimensions and, despite more than satisfactory tests, give the appearance of flimsiness. At any rate, they may be found to detract from the "carlike" appearance of the automobile and time may see the substitution of more substantial looking rims and hubs.

Yearly Models Frowned Upon

The company is strongly opposed, however, to the principle of periodic changes in design, which have been customary abroad as well as in America to attract the crowds at the yearly Motor Exhibition. This custom, which is based rather on faddism than utility, is obviously disastrous to a perfect system of standardization, and will be ignored, so far as possible, in the construction of the Austin "Seven."

As indicated above, the Austin "Seven" is peculiarly a pleasure car. This ignores a principle, which is fairly well established in America, that the automobile, whatever it was in the past, is now at least and in the future is to be both a business necessity and a personal luxury. To the great disappointment of British manufacturers and the astonishment of American exporters, the English commercial classes, slower, perhaps, than Americans to adopt new ideas, have failed to appreciate the possibilities of the automobile in business. In England the motor is still a toy to a very large extent, and as such is quick to feel a temporary trade depression.

The Austin Motor Company, Ltd., has been given as an example of certain conditions in the British motor world because it has shown itself quickest in adaptation to the unfortunate circumstances brought about by the war, circumstances which may, however, in the end prove the reverse of unfortunate. Other automobile factories have the same problem to deal with and may be expected to apply similar methods of treatment. It is not too much to prophesy that Great Britain will be ready to make a serious fight when the markets of the world reopen.

Temperature Recommendations for Thermit Welding

In order to compensate for the lower melting point of cast iron as compared with steel, the Metal and Thermit Corporation, New York, recommends that in preheating cast-iron sections, preparatory to thermit welding them, these sections be heated little more than necessary to show color, such as a dull red heat. If this advice is followed, we are told, a quieter pour will be obtained and the fusion will be just as perfect. This practice has now been tried successfully in numerous cases, the most important being a thermit weld on a large cast-iron press head which required 1,100 lb. of thermit. The weld was absolutely perfect, with good fusion to the extreme of the edge of the collar, although the cast-iron section was heated only to a dull red heat.

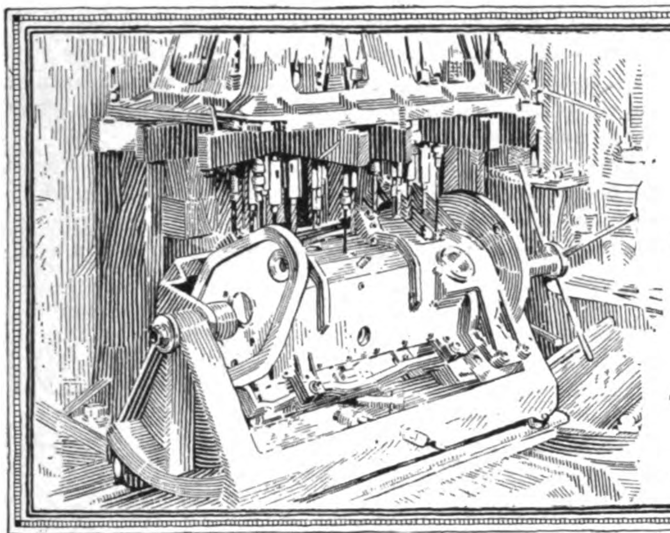
It is believed that this point is very important and that operators will find that it will overcome possible difficulties which they may be experiencing in cast-iron welding. One might suppose that, as the cast iron of the parts being welded is not quite so fully expanded at this lower temperature, there might be a slightly greater tendency for hairline cracks to appear in the thermit steel collar perpendicular to the line of break. In actual practice, however, this has not been found to be the case, probably because of the fact that the expansion curve is much greater up to a red heat than it is from the red heat to the white heat and that the sections are, therefore, practically fully expanded at this dull red heat. It is certainly also true that the thermit steel at first heats and expands the sections with which it comes in contact and that the slight difference in preheating is negligible.

Bonus for Long Service

By A. L. De Vinne

Until an employee commences to get worthless he is a more valuable hand after years of service than when he came, even than after he got into his stride. He knows where things are, he can do some one thing automatically better than any new hand and he can do other things reasonably well from long association with the work and occasional assisting and substitution. He has proved himself likely to stick, and not apt to have a yearning for "fresh fields and pastures new."

This being so, it is well to pay an annual bonus—without any promise, expressed or implied, after the expiration of a given period; the percentage of the wages and the length of the period depending upon the scarcity of the kind of labor in question and the length of time required to learn that particular work.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Details of Design of Blanking Dies Continued—Laying Out Work and Punch Positions Single- and Double-Run Layouts—Double Blanking Dies

IN THE previous article we have discussed a number of general matters pertaining to the design of blanking dies. In these general statements we have endeavored to illustrate points of importance which apply not only to the blanking of the metal or cutting it into shape, but also to the progress of the work through the die and other matters which affect the design generally.

We shall now go into the matter in much greater detail and illustrate a number of points in the design of blanking dies in a graphic manner, bringing out principles which apply to the subject and treating the entire matter from its fundamentals so that the designer will thoroughly understand the principles on which the science of die design is based. It is not our intention to show a great variety of dies for different purposes and for different forms which are to be cut out of metal. Such matters could be presented in very extensive form if it appeared desirable; but there are so many applications of punches and dies to different kinds of work that it seems better to deal almost entirely with principles of design, making each point

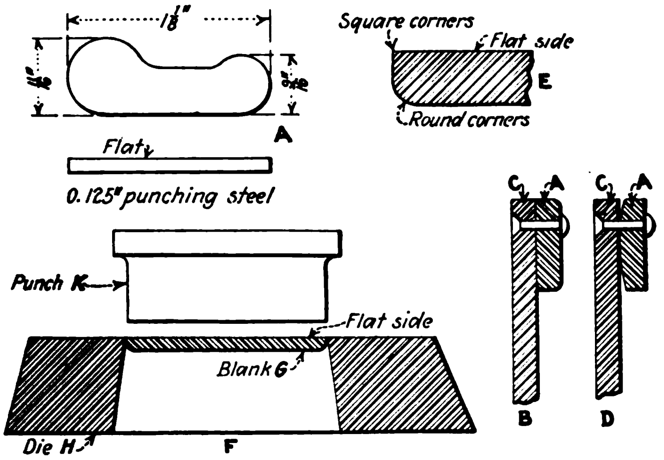


FIG. 450—IMPORTANCE OF ROUND AND FLAT SIDES OF BLANKED WORK

as clear as possible, and then illustrate the application of these principles by means of a comparatively small number of actual examples of dies themselves.

The first point to be considered when it becomes necessary to make up dies for a given piece of work, is the shape of the work which is to be blanked. When considering this matter it must be remembered that all stampings from blanking dies have a round and flat side. The flat side is that next to the punch, while the side which first passes through the die is slightly

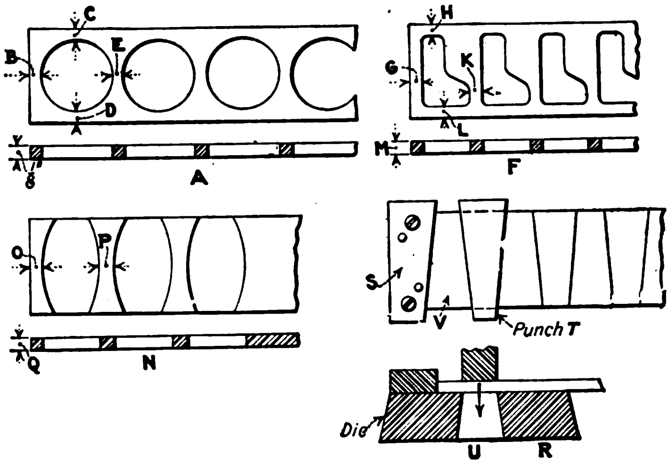


FIG. 451—POSITION OF PUNCH IN BLANKING OPERATIONS

rounded on the corners. When parts are to be assembled with other pieces after blanking, it is necessary that the flat sides should be adjacent to each other. If the work is not symmetrical, the flat side should be specified on the part drawings. Therefore, in designing dies for a given piece of work and in making the most economical layout possible, this point should be considered first. Fig. 450 shows several of these points very clearly.

The part shown at *A* is not symmetrical and it must be laid out so that it will be forced through the die in such a manner that the side which is adjacent to the piece of which it is to form a part will be flat and not round. Referring to the sectional view at *B*, the part *A* is shown assembled with *C* by means of rivets, and it can be noted that the two parts lie closely together. On the other hand, if the curved side of the work *A* were to be assembled as shown at *D*, the piece would not lie close to its fellow and an imperfect unit would be the result.

A sectional view with the conditions greatly exaggerated is shown at *E*, in order to illustrate the differ-

ence between the round and flat sides of a blank. The reason for this difference is clearly indicated in the sectiona view at *F*, in which the work *G* is forced through the die *H* by means of the punch *K*. The rounding of the corner is not noticeable on stock under $\frac{1}{32}$ in. thick and does not need to be considered; but when any work above this amount is blanked, particular attention must be paid to the matter.

In laying out the position of the punch in blanking dies, the part to be punched must be so located that the greatest possible number of blanks will be produced for each length of strip stock. In punching out a round piece such as that shown at *A* in Fig. 451 there is really only one way in which this layout can be made. One point of great importance in connection with the laying out of dies is the distance between the blanks. The space between the blanks and the amount of stock around the blank on the edges should usually be equal to the thickness of the stock being punched. For example, if the work at *A* were $\frac{1}{8}$ in. thick, the various dimensions at *B, C, D* and *E* should also be not less than this amount.

In the example at *F* the blank is somewhat more irregular, but the same rule applies here and the various distances at *G, H, K* and *L* should be uniform and of the same size as dimension *M*. There are occasional cases when it is not necessary to allow a distance equal to the thickness of the stock on the edge of the blank, due to the shape of the work. An example of this kind is shown at *N*. Here the blank is of such shape that the ends do not require trimming so that the only scrap produced is the small piece between each blank; the distances *O* and *P* are equal to the thickness *Q*, but no allowance is made on the edges. If considerable accuracy is required on the width of the blank it may be necessary to select an accurate width of stock, or

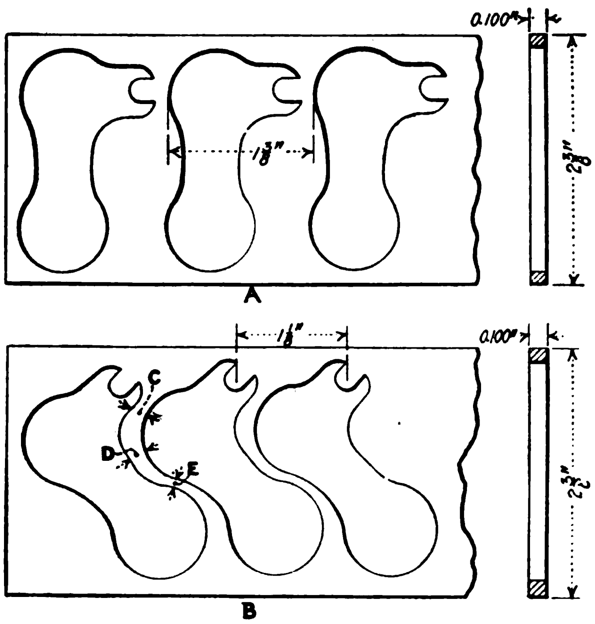


FIG. 452—SINGLE-RUN LAYOUTS, SHOWING TWO METHODS

to run the stock through a "shaver" set to produce the required width.

Another example is shown at R in which the blank is produced without leaving any scrap, and no allowance is made between blanks or on the edges. The work is forced up by the operator against a stop *S*, and the punch *T* is so positioned that on each stroke of the press two parts are produced. One of the blanks passes down through the die, as indicated at *U*, while the other remains on top in the position shown at *V*. Layouts of this kind are unusual, but there are certain times when they may be found an advantage. Naturally the final accuracy of the work has some effect on the selection.

Two methods of laying out a work blank for a single run are shown in Fig. 452. The stock from which the blank is to be made is 0.1 in. thick. In order to illustrate the advantages of a correct layout, a com-

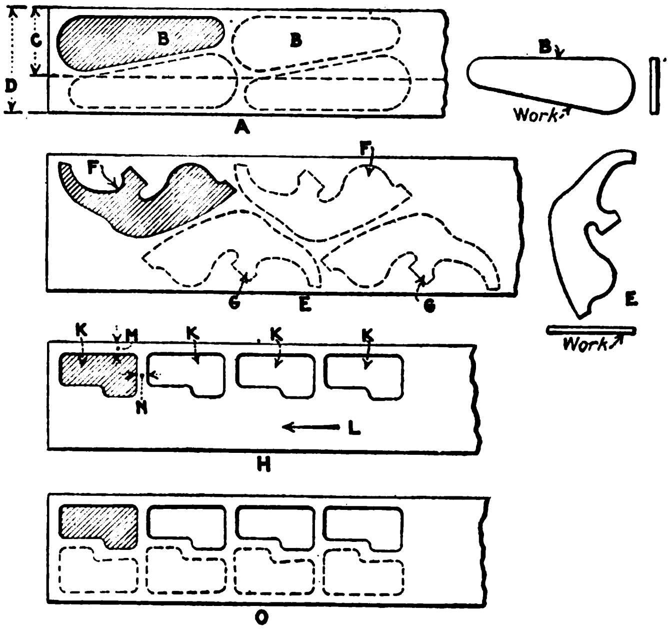


FIG. 453—DOUBLE-RUN DIE LAYOUTS

parison may be made between the two methods indicated. In the example *A* the blank is laid out straight and a distance equal to the thickness of the metal is allowed between blanks. A corresponding amount is also allowed on the edges. The width of the stock required in this method of laying out is $2\frac{3}{8}$ in., the amount of stock required for each blank is $1\frac{3}{8}$ in., and it will be noted that there is a considerable amount of scrap in this layout.

In the example shown at *B* the work has been turned around at a slight angle, so that the width of the scrapped stock is uniform at points *C, D* and *E*, and an equal allowance is made from the blank to the edges of the stock. In this layout the distance between blanks is $1\frac{1}{8}$ in., which is considerably less than that required by the other method. Stock for work of this kind usually comes in lengths of 72 in. The following method can be used to find the number of blanks per strip that can be punched from one sheet of metal, as follows:

$$\frac{\text{Total length of sheet-metal strip}}{\text{Length of blank} + \text{Distance between blanks}} = \text{Total number of blanks per strip.}$$

In the example *A* we find that 52 blanks can be obtained from a 72-in. strip, whereas in the case *B* 64 blanks are obtained from the same strip of metal. There is a gain of 12 blanks per strip by using the method *B*.

In irregular work the designer usually makes pasteboard or paper forms the exact size of the blank, and by adjusting them in various positions and tracing around them it is easy to find the most economical angle at which the punch can be set. This method is commonly used when laying out a die.

A double-run is the term used for a layout in which stock is run through the die twice. Several examples

of double-run die layouts are shown in Fig. 453. In order to illustrate the difference between a single and double run, let us refer to the example *A* in which the blank to be produced is shown by the dotted lines at *B*. If this work were to be made in a single-run die the width of stock might be as shown at *C*, while if a double run were to be made the total width of stock required would only be equal to dimension *D*. In using a die laid out in this manner the stock is blanked on the first run in the usual way, and then the strip is reversed and run through the die the second time.

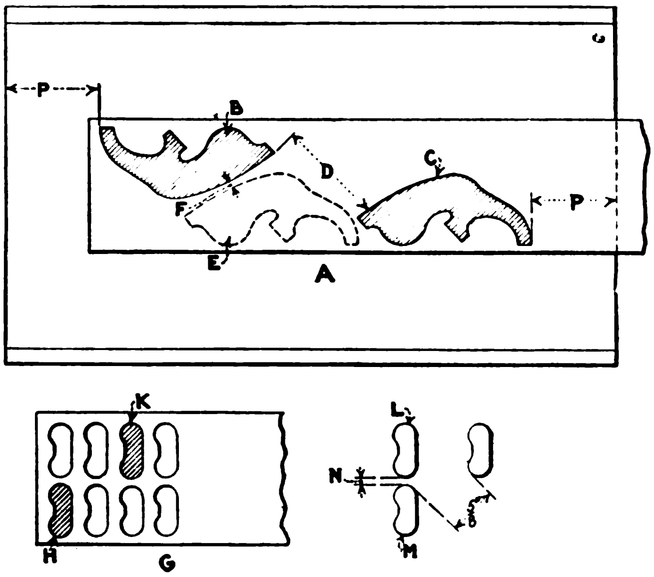


FIG. 454—DOUBLE BLANKING DIE LAYOUTS

The shape of the part determines whether or not a double run should be used. It must always be remembered that there is considerable time wasted in reversing a strip of stock and getting it ready to run it through the second time, so that a double-run die is not always as advantageous as it may appear at first thought. The amount of stock saved in the double-run layout shown at *A* is in that saved in the width of the stock. The blank can, of course, be arranged in a different way and a layout made so that the parts would be produced across the strip instead of lengthwise. This arrangement would take somewhat longer stock and there would be no gain in the final results obtained.

In the example shown at *E* the work is considerably more irregular in shape, but the same principle is applied and a double run made in order to produce the work more economically. The work is fed through the die twice, as in the first case, the blanks being produced at *F;* and then the stock is reversed and the other blanks produced as shown by dotted lines at *G*.

Another example, shown at *H*, illustrates a double-run layout for the blank *K*. The stock is fed in the direction indicated by the arrow at *L* and the blanks are formed successively, stock allowance being made at *M* and *N* according to the thickness of the metal. After the stock has been run through along one edge, the strip is turned and the opposite side blanked, as shown at *O*. In determining whether it is better to make a single- or double-run die the shape of the piece is a governing factor. If less waste is produced by a double run and a considerable saving effected, it is evident that this method is to be preferred.

Double blanking dies are often confused with double-run dies, although there is a distinct difference between them. A double blanking die stamps two pieces at one time, although the layout of the blanks may be the same as that used for a double-run die. A good example of this sort of a layout is shown in Fig. 454 in which the strip *A* is for the same part which was illustrated in Fig. 453. The width of the stock and the number of blanks per strip are exactly the same; but it is unnecessary in a double blanking die to turn the stock around, as the punches and dies are so arranged that the two blanks shown solid at *B* and *C* are cut at the same time at one stroke.

One of the most important points in the design of double blanking die is to make sure that a proper distance between punches is obtained. In the example shown the distance *D* is sufficient for a layout of this kind. If punches were located so as to produce the blanks shown at *B* and *E* at the same time, the distance between holes in the dies would be only the amount shown at *F*, which construction would probably cause distortion in hardening and short life to the die, even if no breakage occurred in hardening.

The size of the die itself should be great enough to permit a generous amount of stock all around the openings, as indicated at *P*. Another example, shown at *G*, brings out this point clearly. In a double-run die for this piece of work the punches should be located so as to produce blanks as at *H* and *K*, in order to allow a sufficient amount of stock to give a long-lived die. If punches were to be located as shown at *L* and *M*, the distance *N* would be too small and trouble would be likely to occur. By locating as shown the distance between holes is much greater and the dies will have a great deal longer life.

A general rule which applies to double blanking dies for stamping work up to 3/16-in. thick is that the distance between the punches should never be less than 5/8 in., and for heavier work this amount should be increased. These points are of great importance when laying out dies, and the designer should keep them in mind.

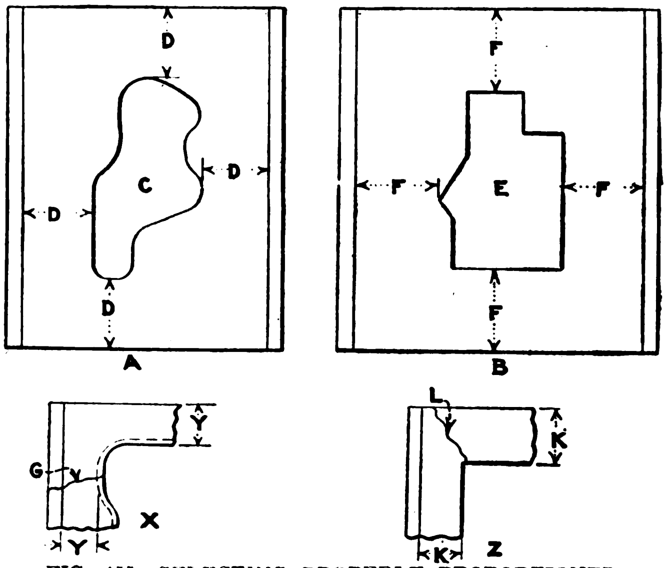


FIG. 455—SELECTING PROPERLY PROPORTIONED DIE-BLOCKS

In addition to double blanking dies, there are occasional cases when multiple blanking dies may be used. The principles on which these dies are designed are exactly the same as those employed in the design of double blanking dies, the only difference being that multiple dies make more parts at one time. It is sometimes found profitable to use something of this kind where high production is desired when blanking.

Mention of the standardization of die-blocks has been made in a previous article; but it is well to speak of the importance of selecting a die-block of generous size, so that it will have long life, and will not be subject to distortion or cracks in hardening on account of an insufficient amount of material being allowed. Fig. 455 graphically illustrates a number of these points.

In the example shown at *A* the die is made to blank the form *C*, which has round corners throughout. The distance between the die opening and the edges of the die as shown by dimensions *D* should be not less than 1¼ in. for stock up to ⅛-in. thick. By making provision of this kind in selecting a standard die-block no trouble will be experienced from distortion in hardening or from breakage caused by thin walls. As the stock increases in thickness the distances around the opening should be increased.

In the example *B* the shape of the blank *E* is to be made, and as this blank has sharp corners the dimensions *F* should be, if anything, somewhat greater than those shown at *A*. The danger of cracks in hardening is greater when sharp corners are required. In the example shown at *X* the distances *Y* are too small, and weakness may develop so that a crack may be formed in hardening, as shown at *G*. A somewhat similar condition is illustrated at *Z*, where the distances *K* are also too small so that a crack develops in the corner as shown at *L*, thus ruining the die. The defect is doubtless accentuated by the sharp corner; yet if sufficient metal were allowed here, there would probably be no difficulty if the hardening were to be done carefully.

A list of standard die-blocks has been given in a previous article, and the dimensions given in this list will be found very useful in connection with the data given here in selecting a die-block for any size of blank.

Moving Pictures in the Machine Tool Industry

By D. S. Hazen

The use of moving pictures as both educational and advertising factors has great possibilities in the machine-tool industry. The first factor, classified as service instruction, includes those films which are specifically built to aid the users and operators of machine tools.

The second factor, classified as educational propaganda or advertising, consists of those films which are built for the specific purpose of interesting potential buyers. In this illustrative way, the features of the processes or products are so presented that the buyer may recognize their good qualities.

The main difficulty up to the present time has been the distribution of the pictures. This has been due to the fact that the purchasers of the films did not first determine to which of the two classifications the film belonged, and did not lay their plans far enough in advance of the making of the film. Advertising managers or company owners would not contemplate any other campaign without a careful study of the whole proposition, and yet they have rushed whole-heartedly into the making of moving pictures without first learning where or to whom the films could be shown.

The wide differences between the two types of films and between the results to be obtained from them, point out how necessary it is to determine, first of all, the purpose of the film. In the second place, examine the field in which it has been decided to use the film, and find out the chances for the distribution which must be obtained in order to accomplish the purpose of the film. In the third place, carefully pick out those specific features of the product or process which will appeal to the prospects in the field in which the film will be used.

After these features have been worked, out, the making of the film becomes comparatively simple. Some general rules for film-editing are as follows:

(1) Make the film as short as possible without omitting any of the necessary processes which should be shown.

(2) Arrange the various processes in a logical order so that the reader of the film may easily follow the idea to be conveyed. In other words, get good continuity.

(3) Reduce "still" scenes to a minimum. (You can send plain photographs for these scenes.) Blend the "live" scenes together so that there will be no apparent break. In other words, get action.

(4) Consider every part of the film from the viewpoint of the potential audience; that is, include what will be of interest to them rather than to the maker of the film.

Outside of an actual demonstration, there is no better way of showing a machine tool or a mechanical process to a man than by a moving picture. Sometimes the "movie" will show the workings of a machine even better, as in the same of the so-called "slow-motion" pictures. Advertising films, which are educational in a way, should show those features of the product which make it a "worth-while buy" for the customer. In the case of machine tools, they should not only illustrate the uses, and the results of the uses of the machine, but also should describe the mechanical reasons why such good results are obtained.

Distribution of Films

It is the writer's opinion that the best distribution scheme of a machine-tool "movie" is the direct circulation from the offices of the machine-tool builder. The more or less technical character of the film as well as the special character of the field in which the film will be welcomed, makes the circulation problem rather a strange one to the general distributing agencies unacquainted with the machine-tool industry.

A centralized bureau is needed as a clearing house to collect all the types of films and to offer specific fields for them. This is presumably the idea back of the co-operation plan of the National Association of Manufacturers and of the government. The latter is undertaking the distribution of well-made films through a special department in the Bureau of Foreign and Domestic Commerce.

The more important work of the Bureau will be the exploitation of American products in the foreign markets through an educational campaign which uses moving pictures as the medium. Several foreign countries are now using the "movies" to show their products in the foreign fields. However, the well-known superiority of the American-made film gives our film advertising a much easier start. By the use of moving pictures, the difficulty of explaining technical processes or machines in a foreign tongue is also overcome.

Blanking and Piercing Tools for Watch Parts

Escapement Is Important Feature of Movement—Accurate Workmanship Essential Pillar-Type of Sub-Press Used—All Working Parts Ground and Lapped

BY I. BERNARD BLACK

IN THE design and construction of dies for watch parts a great deal of time, care and forethought is demanded because of the extreme accuracy required of the product of the tools; and of no part of the watch mechanism is this more true or the work more exacting than in making those tools that are to produce the several pieces comprising what is known as the "escapement." This escapement is, perhaps, the most vital part of the watch movement, and in its making and adjustment none but the services of an expert can be employed if the time-keeping qualities of the watch are to be assured.

In this article the writer will endeavor to describe the dies that produce the pallet, a very important part of the escapement, and in order to make clear to the reader the necessity for extreme accuracy in their design and construction, will briefly explain the functions of this part.

The escapement is that part of a watch movement by means of which the rotative movement of the wheels is transformed into the vibratory, or oscillatory, motion of the balance. The members included in the escapement are the escape wheel, the pallet, the fork, the impulse pin, and the roller or rollers. The balance itself is not properly included.

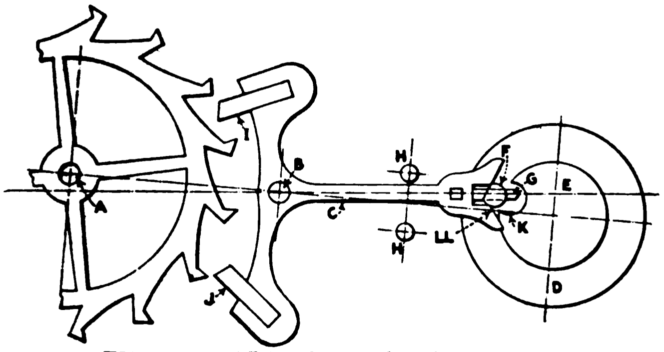


FIG. 1—DIAGRAM OF THE ESCAPEMENT

In Fig. 1 is shown a diagram of the movement, the letters referring to the various parts as follows: *A* is the escapement wheel; *B*, the pallet; *C*, the fork; *D*, the impulse roller; *E*, the safety roller; *F*, the impulse pin; *G*, the guard pin; *HH*, the banking pins; *I*, the receiving, or right, stone; *J*, the discharging, or left, stone; *K*, the roller crescent; and *LL*, the fork horns.

As may be seen in the sketch, the pallet is the part that holds the stones that lock and unlock the teeth of the escapement wheel, causing it to move intermittently. The forward and backward movement of the pallet, a movement governed by the balance but which really derives its actuating impulse from the escapement wheel, is what times the watch. If the pallet should be inaccurate in regard to any one of its many features, such as the position of the arbor hole, a wrong position or angle of the slots that hold the stones, or the fork horns not being punched in exactly the right place or at the correct angle, the timing would be defective.

In Fig. 2 is shown a drawing of the pallet, which will serve to show how truly complicated is its design. There are many styles and kinds of pallet, each design involving an amount of calculation that would astonish the uninitiated; yet the slightest error in any one of the many calculations would greatly affect the value of the watch as a time-keeper. The writer has handled

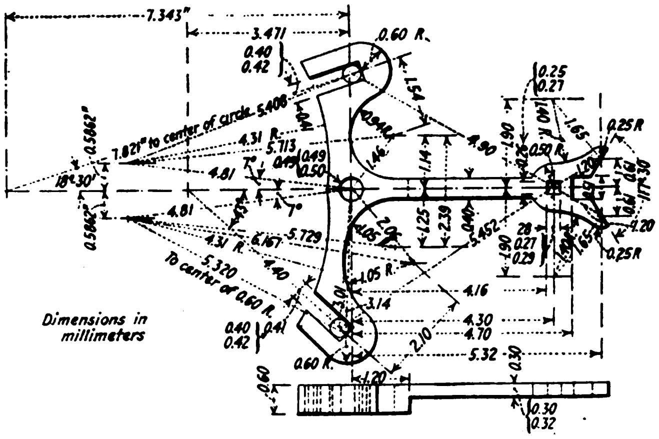


FIG. 2—DRAWING OF PALLET. DIMENSIONS IN MILLIMETERS

Swiss watches that were guaranteed to keep time within 15 seconds fast to 20 seconds slow in 24 hours, a variation so slight that it is hardly appreciated by the average watch-owner. Slight as this variation is, however, it can be improved upon and the watch factories of today are working toward that end.

In Fig. 3 is shown the way in which the stock is shaved before it is fed to the die. The stock used is strip brass 1/8 in. wide by 0.024 in. thick, and comes to this operation in 6-ft. strips. The strip is run through the blanking tools twice, as will be explained later.

A three-station die, mounted in a pillar-type sub-press, is used to blank the pallet, and in Fig. 4 may be seen a section taken through the second station. At the first station the two pilot holes and the pallet-arbor hole are pierced, and a part of the stock cut away around the fork horns to relieve the blanking tools of a part of the burden. At the second station the pallet is blanked out of the stock, but is immediately pushed back into it again by the action of the shedder on the up-stroke of the press. At the third station the completed blank is pushed out of the stock and falls through the die into a receptacle beneath the press.

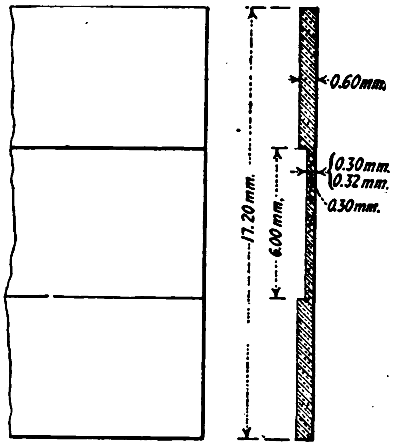


FIG. 3—STOCK PREPARED FOR BLANKING

Part *A* is the die holder, made of machine steel and pack-hardened; part *B* is the blanking die, which is made of tool steel in three pieces; part *C* is the shedder,

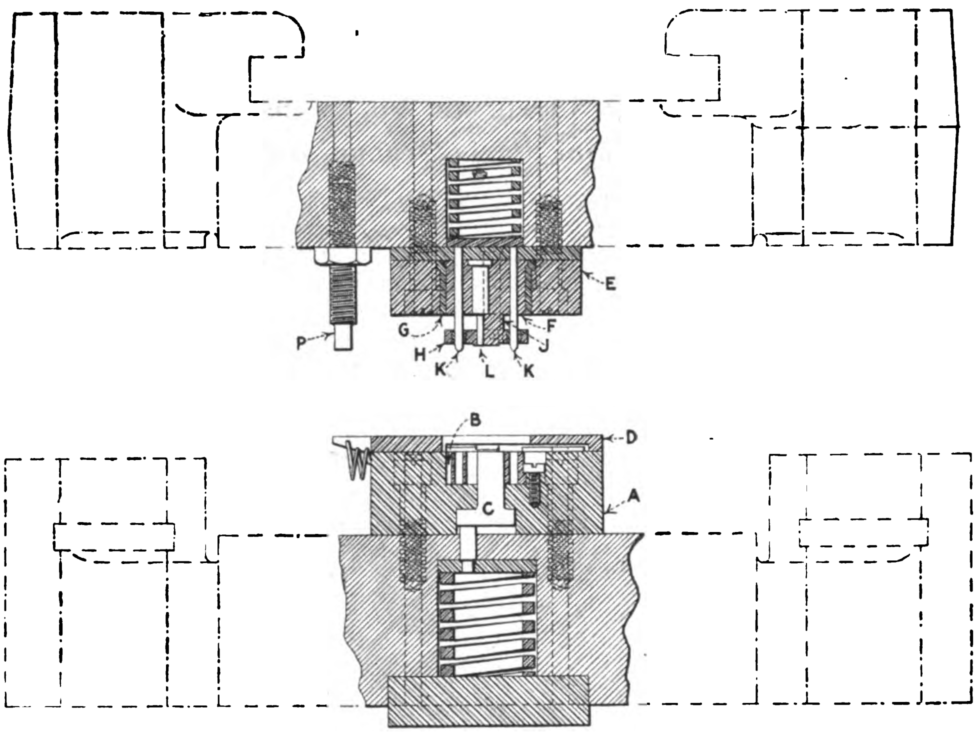


FIG. 4—SECTION THROUGH THE BLANKING DIES

punch portion is made to correspond to the contour of the die but is 0.012 mm. smaller all around than the latter. Part *H* is a spring stripper, made of tool steel, hardened, and ground out to fit the blanking and piercing punches, and it is retained in place by three screws, part *J*.

Parts *KK* are the pilots, made of tool steel, hardened. ground and lapped to a drive fit in *F* and a sliding fit in the bushed holes of the stripper. On the downward stroke of the press the blanking punch *F*, the gutting punch *L*, and the pilots *KK* enter the blanking die, compressing the stripper and shedder springs. On the up-stroke the blank, which at this time is out of the stock and lodged in the die, is pushed back into the stock by the shedder, through the action of its spring.

also of tool steel and a sliding fit in the die; part *D* is the stripper, made of machine steel, pack-hardened and provided with a runner as shown in the drawing so that the shaved portion of the stock will always bear against a straight-edge to prevent mis-alignment while piercing and blanking.

Part *E* is the punch block, made of machine steel and pack-hardened. Part *F* is the blanking punch, the body portion of which is ground and lapped to a drive fit in the bushing *G* of the punch holder, while the

In Fig. 5 is shown a plan view of the blanking dies. Here may clearly be seen what operations take place in each of the three stations.

It will be noticed that two stops are used. In order to feed the stock accurately up to the automatic stop *M*, the temporary stop *N* is used and the stock fed by hand until the automatic stop is reached, when the roll feed is thrown into action. On the second stroke of the press the stock is pulled over the pin *O*, and upon the third stroke the temporary stop *N*, a sketch of which

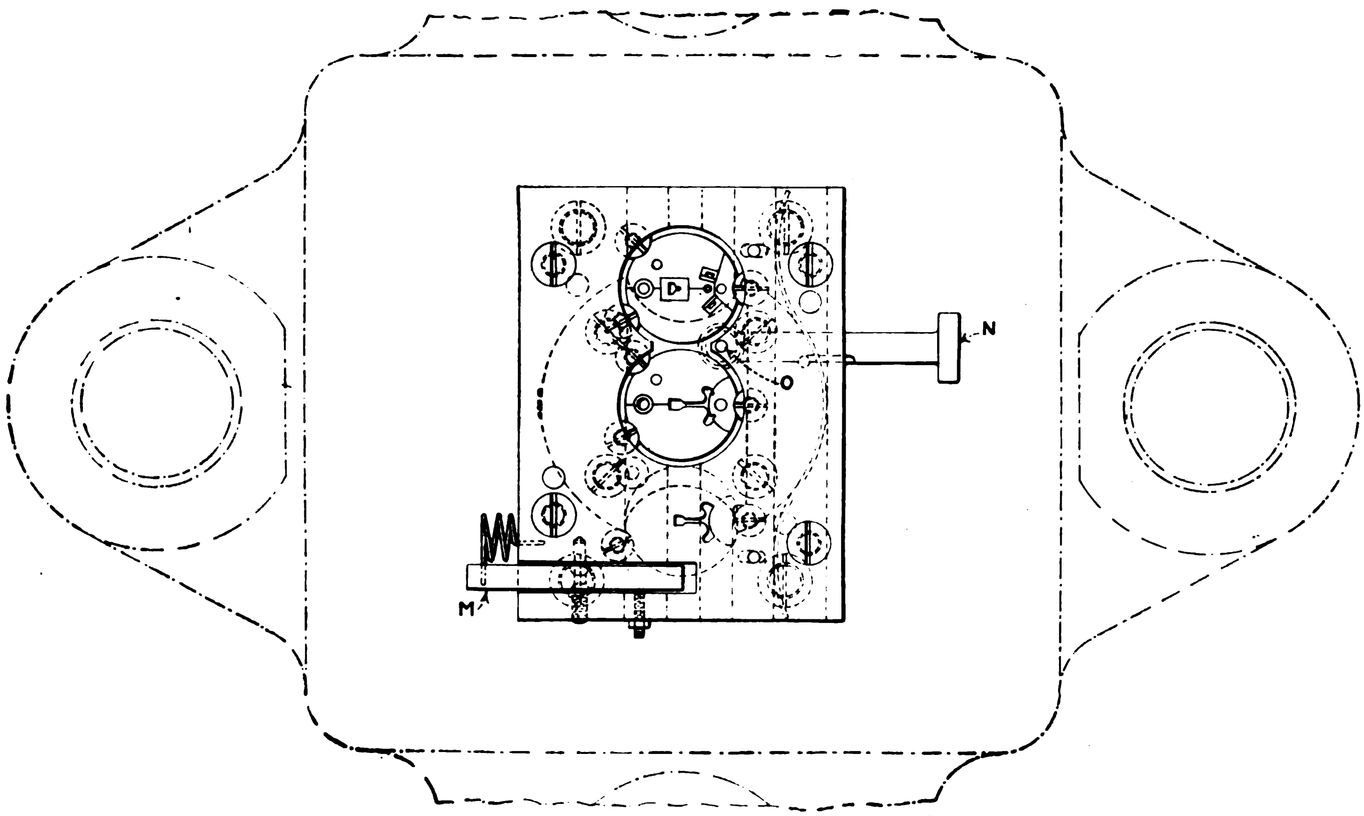


FIG. 5—PLAN VIEW OF THE BLANKING DIES

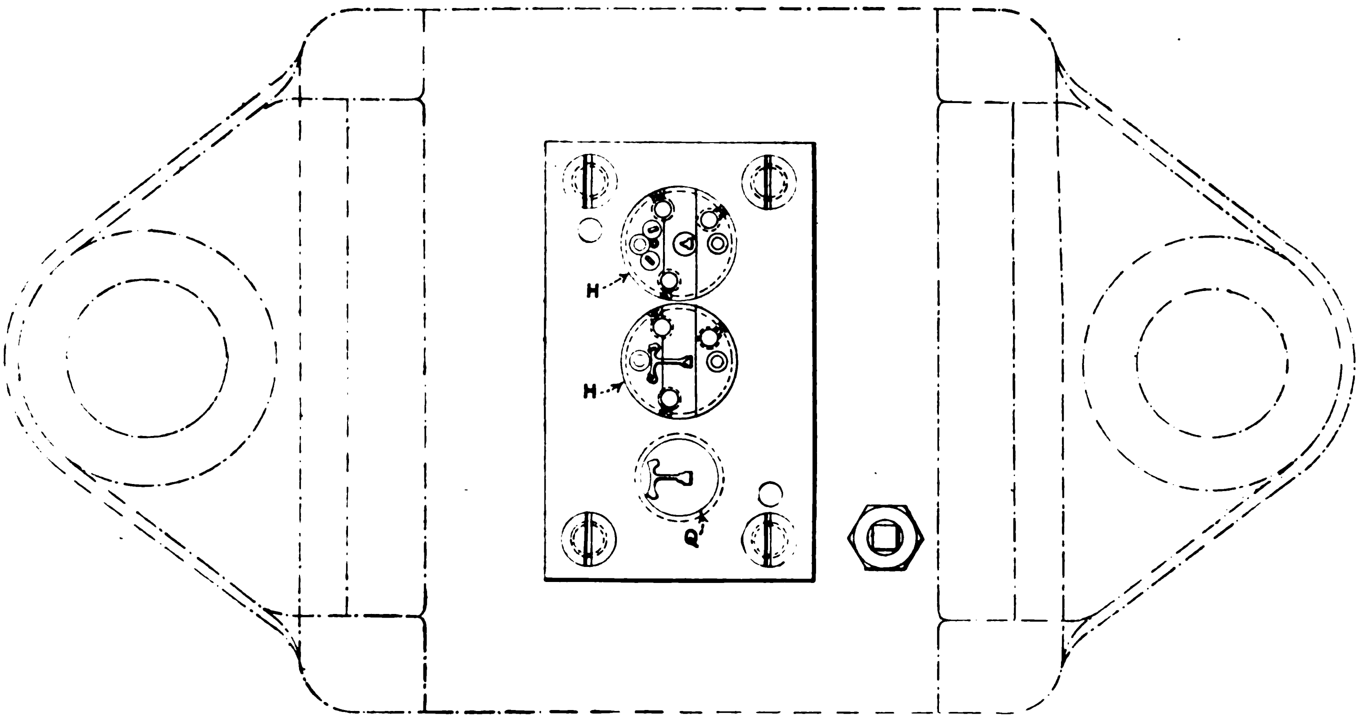


FIG. 7—PLAN OF THE PUNCHES

appears in Fig. 6, is pushed in, causing the pin *O* to go below the surface of the die. The automatic stop is of the trigger type with a projecting end against which the adjustable screw *P* (Fig. 4) contacts as the press descends.

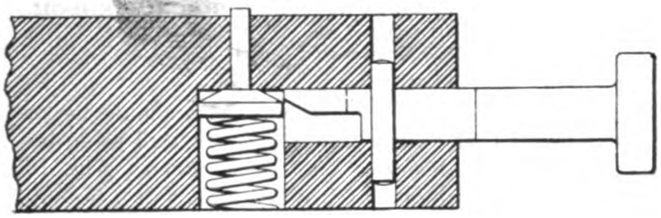


FIG. 6—DETAIL OF AUXILIARY STOP

In Fig. 7 is shown a plan view of the punch block. Here may be seen the two spring strippers, parts *HH*. The knock-out punch *Q* is made to conform to the contour of its die, but is 0.05 mm. smaller.

In Fig. 8 is a sectional view showing the construction of the piercing and gutting punches. The two outside punches *RR* are the piercing punches for the pilot holes and are lapped to a driving fit in the punch holder. The piercing punches *S* and *T* and the gutting punch *U* are a driving fit in the punch holder and a sliding fit in the stripper bushings.

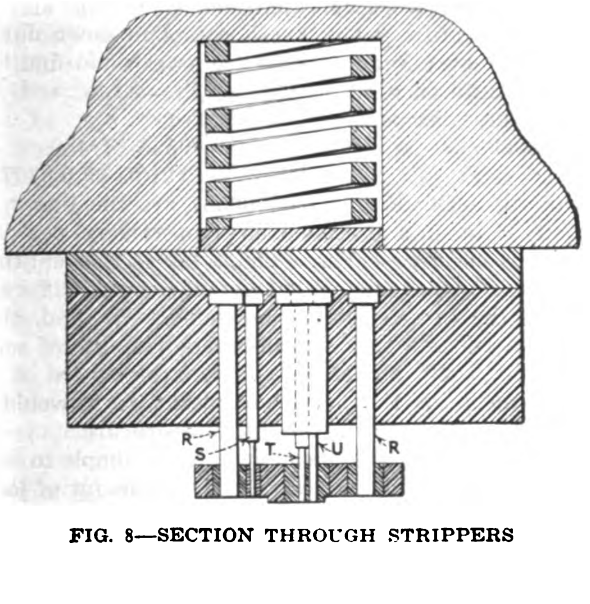


FIG. 8—SECTION THROUGH STRIPPERS

Very little trouble was experienced from breakage of the punches in using this die because of the fact that they were fully supported by the strippers during the time of cutting.

The Foreman and the Management—Discussion

By Arthur Seekay
Lynford Gardens, Essex, England

On page 898, vol. 56 of *American Machinist*, A. W. Brown attempts to define in a few words the position of the foreman in regard to the management. In my opinion no hard and fast rule can be laid down on this subject. I am convinced, by experience, that in small shops, employing anywhere up to 300 hands, the foreman must, without any qualifying clause, take part in the management of the works.

Much depends upon the efficiency and sagacity of the management, as a matter of course, but it must be acknowledged that there is often lack of consideration for the foreman and, in such case, the foreman should watch the interests of those working under him. He is in the best position to understand their temperaments and troubles. On the other hand, by refusing to associate himself with silly grievances and petty demands he can often overcome trouble and save his managers much loss of time and temper.

There should be no question of "running with the hare and chasing with the hounds." If he fails to determine what is right and just, or to exert his influence to achieve those ends which are proper, he will never have the confidence of either side.

Methods of Machine Tool Design

Continuing the Section on Feed Mechanisms for Machine Tools—The Problem of Expansion Due to Temperature Changes—Thrust Bearings

By A. L. DeLEEUW
Consulting Editor, *American Machinist*

In many cases half nuts are used in connection with a feed screw. It is well known that opening and closing half nuts cannot be used with the square thread. Without going into an analysis or graphical demonstration of the reason why a square thread cannot be used, we may picture for ourselves a shaft with a number of square threaded collars turned on it—a kind of cylindrical rack of which the teeth have the contour of a square. A half nut, if we are permitted to call it a nut at all, could be brought to bear on this shaft. The reason why this is possible is that the threads are at right angles to the axis; in other words, that there is no lead. If there were any lead at all it would not be possible to bring the half nut down on the screw except that, if the lead were inconsiderable and some clearance were left between screw and nut, it would still be possible to bring the nut on the screw simply because there would not be a true fit between the two. If there were such a fit we could overcome the difficulty by making the thread slightly taper, say with an angle of one or two degrees on a side. We would have to increase this angle when we increase the lead.

The Acme thread has sufficient angle to permit of throwing in the half nut with most ordinary leads. However, when we try to obtain greater efficiency of the screw by increasing the lead, as we should, we may find interference between screw and nut. This interference is greatest at the points of the half nuts where they join, and it is quite customary to bevel the half nuts as shown in Fig. 154. Even this is not sufficient with large leads, or as we should rather say, with large angles of helix. If, for any reason, we do not wish to increase the angle of the thread beyond a certain amount—for instance, we wish to use the Acme thread—we will find that we are not permitted to use an angle of helix beyond a certain point; and if this would not give us a sufficient lead, then we would have to increase the diameter of the screw. In many machine tools very long screws must be used. Such screws should always be arranged to have them in tension when under load. Buckling effect, as a result of being in compression, will cause the screw to bind hard in its nut and in the bearings, besides being liable to cause severe jumping of the tools, as a screw would act very much like a spring. In lathes where practrically all cuts are taken toward the headstock, this condition is automatically met, because the logical place to have a thrust bearing for such a screw is at the headstock end. Nothwithstanding this natural way of constructing the screw, some screws of heavy lathes have come under the writer's observation which have the thrust bearing at the tailstock end, so that they do their heavy work under compression. Such construction is indefensible.

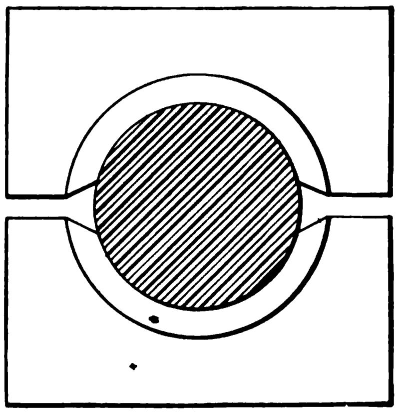


FIG. 154—PAIR OF HALF NUTS WITH BEVELED EDGES

There are cases in machine tool construction where a screw must do work in both directions. This happens, for instance, in plate planers. In such cases we will have wrong conditions at whichever end we place the thrust bearing, and for that reason there should be two thrust bearings, so placed that the screw will be in tension in whichever direction the cut is taken. Fig. 155 shows such an arrangement in diagram.

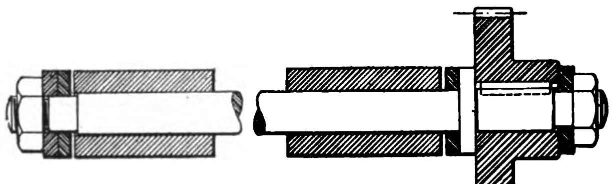


FIG. 155

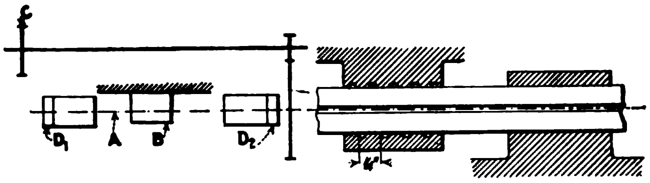


FIG. 157 FIG. 158

FIG. 155—PLATE PLANER LEAD SCREW WITH TWO THRUST BEARINGS. FIG. 157—FEED SCREW DRIVEN THROUGH SEPARATE SHAFT. FIG. 158—LEAD SCREW USED AS FEED ROD

There is no necessity for the use of such a thrust bearing arrangement except when the screw is fairly long, and when this is the case we may find that there is enough difference in expansion and contraction between the screw and the frame of the machine to require special attention. If, for instance, the length of this screw between the thrust bearings is 40 ft. and if the highest temperature to which this screw may be subjected under working conditions is 90 deg. and the lowest temperature when the shop is shut down during the night or over Sunday is 10 deg., we would find that the total difference in length of the screw and bed between these temperatures would be

$$0.00000636 \times 480 \times 80 - 0.00000556 \times 480 \times 80 = 0.2442 - 0.2135 = 0.0307;$$

in which 0.00000636 and 0.00000557 are the linear expansion of steel and cast iron respectively per unit length for one degree Fahrenheit; 480 is the length of the screw in inches, and 80 is the temperature difference to which the screw may be subjected. We find, then, that there will be a possible difference in length of screw and bed of 0.030 in.; so that if the screw were of the proper length for the higher temperature it would be practically $\frac{1}{32}$ in. short at the low temperature.

In the case of a plate planer it is quite simple to overcome this difficulty by leaving a certain amount of looseness; for instance, making the screw $\frac{1}{32}$ in. longer than the distance between the thrust bearings on the bed.

This looseness would be taken up at every reversal of the stroke and no harm would result.

In the case of a feed screw on a lathe, where it should be necessary to have thrust bearings at both ends (which is only rarely the case) the same method might be applied. If such a screw also must be used as a lead screw it it not advisable to follow this construction and it may be better to give the screw a length which is correct, not exactly for the highest temperature, but for

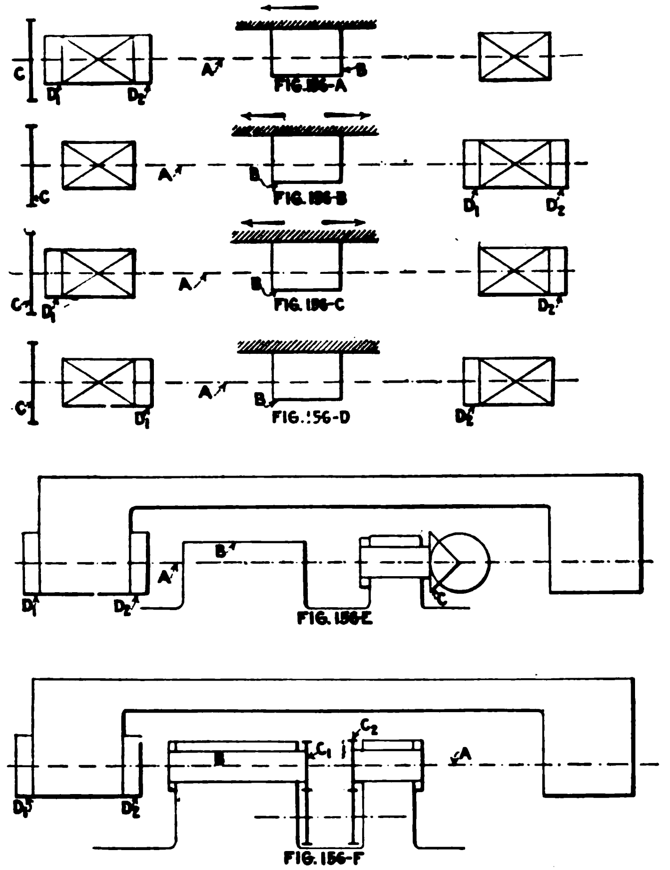


FIG. 156—VARIOUS ARRANGEMENTS OF FEED SCREW PARTS

the average temperature in the shop, say 65 deg. There might then be a looseness due to 25 deg. difference in temperature during hot summer days, whereas during a cold winter night there might be a difference in the opposite direction of 55 deg.

Under these latter conditions the screw would be subjected to a certain amount of tension, due to the fact that there would be a difference of 0.020 in. in length between the bed and screw. If the material of this screw had a modulus of elasticity of 30,000,000 lb., this difference in length would cause a stress in the screw of $20/480 \times .001 \times 30{,}000{,}000 = 1{,}250$ lb. to the square inch. This amount is not harmful to the screw, but adds very largely to the pressure on the thrust bearings. If, for instance, we should have a screw of which the core is $2\frac{1}{2}$ in. in diameter and therefore has a cross section of 4.9 sq.in., there would be an added pressure on the thrust bearings of $4.9 \times 1{,}250$ lb. $= 6{,}125$ lb., and it would therefore be necessary to have a much enlarged thrust bearing or much heavier ball bearings, or perhaps an entirely different arrangement to take up the thrust.

In Fig. 156-A to -F are shown various arrangements of feed screw, nut, driving gear, and thrust collars. In Fig. 156-A the thrust collars are placed close to the driving gear, so that if the feed takes place in the direction of the arrow the screw will be in tension, the thrust collar D_1 will function, and the distance between the driving gear and the active thrust collar will be a minimum.

In Fig. 156-B the thrust is taken up at the far end of the screw, so that when the feed takes place in the direction of arrow 1, thrust collar D_1 will be active and the screw will be in compression. There is, of course, a certain amount of torsion in the screw between the gear C and the nut B on account of the load and the friction in the nut; but in this arrangement of the elements there will be additional torsion due to the load at the thrust bearing. When the feed takes place in the direction of arrow 2, thrust collar D_2 is active, the screw is in compression and again is subjected to the additional torsion caused by the friction of the thrust bearing.

Expansion and Contraction of Screw

In Fig. 156-C the thrust bearings are so located that the screw is always in tension in whatever direction the feed may take place. In this construction provision must be made for expansion and contraction. When the feed takes place in the direction of arrow 2, the entire length of the screw is in torsion due to the driving gear and thrust collar being at opposite ends of the feed screw. There are cases where a feed screw must be kept of small diameter; for instance, where it has to be laid in a long boring bar. In such a case the torsion of the screw is quite considerable, causing a shortening of the screw which, in its turn, causes a considerable pull on the far thrust bearing. This pull may become so great that, if the screw were driven by a pulley instead of a spur gear as shown in the illustration, the belt might not be able to turn the screw, and that notwithstanding the legitimate load might be quite small. This is a case of building up of resistance which we often meet in machinery where the elements have not been properly designed.

There are cases where it is unavoidable to have the thrust bearing at the far end of the screw and where it is not possible to make the screw as heavy as might be desirable. In such a case it is well to take the driving member C off the screw and place it on a separate parallel shaft, and then drive the screw at the far end close to its thrust bearing; see Fig. 157. Though the total amount of torsion has been increased, there is no tendency here to build up. Fig. 156-D is practically the same arrangement as that shown in Fig. 156-C, except that the thrust collars are placed on the opposite side of the bearings. This construction brings the screw in compression at all times, and we could hardly imagine any case where it would be justified.

Screw Fixed and Nut Rotating

In the foregoing four cases the screw was being driven while the nut was fastened to the member which was to be advanced. It is equally possible to have the screw held in the member to be advanced. This case is shown in Fig. 156-E. The sleeve bevel gear C drives the screw which, of course, must be provided with a spline. It is undesirable to use a splined screw, though there may be cases where such may be the best possible compromise. This matter of splined screws will be touched upon later. In all the foregoing cases the screw was the rotating member. It is, of course, possible to have the nut rotate, in which case the thrust bearing must be at the nut and not at the screw. This con-

struction has the advantage of avoiding all torsion in the screw with its consequent change of lead, and of having the thrust close to the drive, and therefore never exaggerated by torsion in the driven member.

It is also possible to drive both screw and nut, as indicated in diagrammatic form in Fig. 156-F. In that event both screw and nut must be provided with thrust bearings. The rapidity of the feed depends on the difference in speeds of screw and nut. If, in the case illustrated, the screw had a right-hand thread, were rotating alone, and in a right-hand direction, it would cause the table to move to the right. If the lead were ½ in. and its speed 300 r.p.m., the rapidity of the feed would be 150 in. per minute and in a right-hand direction. If the nut alone were revolving, and also in a right-hand direction and at a speed of 300 r.p.m., the rapidity of the feed would be again 150 in. per minute, but this time in a left-hand direction.

If both screw and nut were revolving simultaneously with the same speed and in the same direction, there would be no feed at all; if in the opposite direction the feed would be 300 in. to the right or left, according to whether the screw would be rotating right- or left-hand. If screw and nut were revolving in the same direction, but at different speeds, the feed would be equal to the difference of the feeds which would be obtained if either of the two members were running alone and in the direction which would be caused if the fastest member only were running. For instance, if the screw were running 300 r.p.m. and the nut 280 r.p.m., we would obtain 10 in. feed per minute in the direction of the feed which would be given by the screw alone, that is, right handed. If, on the other hand, the screw were running 280 r.p.m. and the nut 300 r.p.m., the feed would again be 10 in. per minute, but in the opposite direction.

Such an arrangement lends itself very well for various functions of automatic machines, as rapid traverse in either direction, feed in either direction, and stopping all can be obtained with simple members. It should be noted, however, that it is necessary to lock the stationary member against rotation caused by the friction between it and the rotating member.

Bearing Requirements

It is of the greatest importance to arrange for the proper thrust bearings, and in general for the elimination of friction when using the arangement of rotating screw and nut. We will suppose the screw to run 300 r.p.m. and the nut 298 r.p.m., which will give 1 in. feed per minute if the lead of the screw is ½ in. as was assumed. In order to feed 1 in. the screw must make 300 revolution under the full feed pressure, and the nut at the same time must make 298 revolutions under the same pressure.

To show how very inefficient such a drive would be, we will select a concrete example, making the screw 2 in. in diameter, ½ in. lead, single thread, and therefore with a pitch diameter of 1¾ in. We will assume the load to be 4,000 lb., the thrust washers on the nut to have an inside diameter of 1¾ in. and outside diameter of 3¾ in., while the thrust washers on the nut will have an inside diameter of 2½ in. and an outside diameter of 4½ in. Then the amount of work done for advancing the load 1 in. will be 4,000 in.-lb. As the screw has rotated in the nut 2 revolutions for 1 in. advance, the work done for overcoming friction in the nut will be 5½ $\times$ 0.15 $\times$ 4,000 $\times$ 2 = 6,600 in.-lb. (5½ is the pitch circumference of the screw and 0.15 the coefficient of friction of the screw in nut).

The work done for overcoming friction at the thrust washers of the screw is 11/4 $\times$ 22/7 $\times$ 0.08 $\times$ 4,000 $\times$ 300, in which 11/4 is the average diameter of the thrust washer, 300 the number of revolutions of the thrust washers for 1 in. feed, and 0.008 the coefficient of friction of the thrust washers. This amount is equal to 829,710 in.-lb. The work done for overcoming the friction at the thrust washers for the nut is 3½ $\times$ 22/7 $\times$ 0.08 $\times$ 4,000 $\times$ 298, in which 3½ is the average diameter of the thrust washers and 298 is the number of revolutions made by the nut for 1 in. feed. This amount is equal to 1,048,960 in.-lb., so that the total amount of work is 1,048,960 + 829,710 + 6,600 + 4,000 = 1,889,270 in.-lb. for a useful amount of work done of 4,000 in.-lb. The efficiency is therefore 4/1,889 or less than one-fourth of one per cent. The actual efficiency will be even less than this amount because friction in bearings, etc., has not been figured in.

Effect of Anti-Friction Bearings

This shows that the arrangement of rotating screw and nut is not practical unless a different construction for thrust bearings is used. Substituting ball bearings for the thrust washers, we will find the following: With a well constructed ball bearing the coefficient of friction is well within one-hundredth of one per cent, so that the two large amounts we found for friction in the thrust bearings may be divided by 800. Besides, the average diameter of the ball bearing will be considerably less than the average diameter of the thrust washers we had assumed. We will find, then, for the work done at the thrust bearing of the screw something like 800 in.-lb.; for the thrust bearing at the nut about 1,000 lb.; so that the total amount of work done would be 800 + 1,000 + 6,600 + 4,000 = 12,400, which gives a total efficiency of a little more than 30 per cent.

It should be kept in mind that all the figures here were assumed and are only fit to give a rough impression of the relative efficiency of this kind of drive with and without ball bearings as compared to that of the ordinary feed screw. When it comes to actual construction, the designer should carefully investigate the data and not accept the rough figures taken here.

Feed screws are often constructed with a spline. This spline is sometimes used to drive the screw and sometimes for the purpose of driving some other part by the screw. The splined screw is often condemned indiscriminately and without considering the purpose of the spline. If the spline is merely for the purpose of driving the screw and if conditions are otherwise as they should be, there is little to be said against such a construction. The points to be considered to make such a drive successful are: In the first place, the careful removal of all burrs where the threads of the screw meet the spline. Preferably these threads should be rounded over slightly for a short distance. In the second place, the length of key should be sufficient to make up for the fact that its bearing surface has been reduced by the threads. In the third place, the key should be of hardened steel if possible.

We have a different set of conditions when the screw drives some other member. As illustration we may take the quite common construction of a lathe apron in which the screw is used both as lead screw and as feed rod. When used in this latter capacity the screw drives

some gear which is used to transmit motion to the rack pinion. Such a screw must have one or two bearings in the apron besides the half nuts. To make clear what will happen when such a screw is used for these different purposes we shall assume certain figures, see Fig. 158. The lead of the screw is supposed to be $\frac{1}{4}$ in. and we shall further suppose that it is geared in such a manner to the rack opinion that one revolution of the screw causes an advance of $\frac{1}{16}$ in. when it is used as a feed rod.

When the screw is used as a lead screw it will cause an advance of $\frac{1}{4}$ in. per revolution. As the bearings in the apron advance the same amount as the half nuts, namely $\frac{1}{4}$ in. per revolution, the screw will travel in these bearings just as if they were nuts and it will cause the wear in these bearings to take the form of a shallow thread. If now later on the same screw is used as a feed rod, it will cause the apron with its bearings to advance $\frac{1}{16}$ in. so that the edges of the thread of the screw will act as cutting tools and cut out the thread worn in the bearings. This action will be repeated and it will be only a very short time before the screw will be very loose in its bearings, will be practically unsupported, and will cause looseness in the subsequent gearing. A lead screw should not be used as a feed rod.

On the other hand it is permissible to drive a screw by means of a spline, whether it is used for feed only or for producing the lead in screw cutting.

What Are the Worker's Prospects in the Machinery Building Industry?

By Gaylord G. Thompson

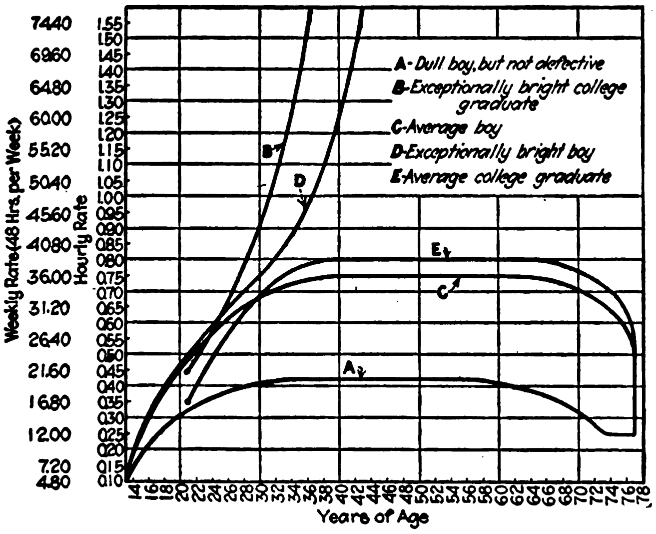
The article under the above title by A. W. Forbes, appearing in the *American Machinist*, Vol. 55, page 667, is an excellent preliminary to the possibilities of developing standard curves for ascertaining the impartial monetary valuation of labor.

I am submitting a drawing of curves which takes into consideration not only the starting point of a worker's career, but also the approximate ending of his services. In fact these curves represent the periods of increased returns, constant returns, and diminishing returns, as they concern the value of the worker's period of uninterrupted service to the employer.

In analyzing the proportional values of the curves as submitted by Mr. Forbes, I have come across an element wherein the "exceptionally bright boy starting machine work at fourteen years of age," is given considerable advantage over the "exceptionally bright boy entering machine industry after graduating from college." Apparently, Mr. Forbes contends that a bright boy beginning at fourteen years of age and working three years until seventeen years of age, is of the same value to a concern as a bright boy graduating from college at the age of twenty-two years.

It is hard to conceive of any concern that would place a higher monetary value on a boy of seventeen years old with three years machine work experience, than on a matured young man of twenty-two years, a graduate from college. Picture these two young men standing before you. You have their applications for a position. On reading over their outline of experiences you could not evade the impulse to concentrate your attention to the college graduate. He already has the foundation upon which to build rapidly, the particular structure that may fit him in as an important cog in your organization. Of course the college graduate will be hired in preference to the seventeen-year old boy especially when the wage rate is equal. Even though a bright seventeen-year old boy who has worked for you for three years is unconciously drawn into the controversy as a basis of comparison with the college graduate for labor value, you would still feel that you were grabbing a bargain if this technically trained man would start work for the same amount paid to the seventeen-year-old boy.

The argument may be advanced, however, that a worker who has been with a company for a number of years is of more value to a concern from a production point of view, than a recent college graduate who is not familiar with the manufacturing methods of that particular concern. I believe this to be true only when the shop man has gone through a sufficient number of years training that will in a measure counteract the advantage which the college graduate has in his technical training. We must not lose sight of the fact that college graduates who intend entering the machinery manufacturing industry are considerably advanced in actual manufacturing experience due to the intensive training which they receive in machine shop practice during their



WAGE RATES IN THE MACHINE SHOP

school terms and summer vacations. Consequently, when such men enter into the manufacturing field, their rise, starting from a slightly lower level than the existing wage rate of the exceptionally bright worker and on equal footing with the ordinary worker, is more rapid than these two classes of workers. The lines of valuation should converge. The line representing the most rapid increase in value of service will cross all others that are the nearest competitors. This line, which represents an exceptionally bright college graduate, is shown in the accompanying chart as *B*.

Line *D* represents an exceptionally bright boy who has found time to acquire technical training outside of his working hours. It will be noticed that this line does not show such rapid strides in the attainment of increased valuation of services as line *B*, until approximately six years after the same achievement has been accomplished by line *B*. Owing to the fact that *D* is compelled to obtain his technical training under conditions that do not allow him to devote his full time to

that phase of the work, he must necessarily be reconciled to the necessity of delayed realities of visualized ideals.

I believe that I voice the opinion of the majority in that the ultimate attainment of high remuneration is most quickly brought about through the instrumentality of a college education preceding practical experience.

The curves, as shown by Mr. Forbes, representing the college graduate (*C'*) and the exceptionally bright boy (*C*), are in my opinion directly opposite to the correct interpretation of them. It does not seem logical that the worker without college education preceding practical experience, should show quicker results than a college training supplemented by practical experience.

Line *C* represents the ordinary worker who is content with being an all around machinist, toolmaker, or the head of some department whose functions contribute to office routine.

Curve *E* represents the average college graduate who comes under the same category as curve *C*, but owing to his advantage of a college education his curve of service valuation should be more pronounced at the beginning and gradually terminating at a slightly higher stationary valuation than *C*. Likewise we have consistent relativity with curves *B* and *D*.

Curve *A* represents a worker lacking in college training, who is satisfied to remain in the class of a machine operator or clerk. In this class of workman, the element of physical ability is the barometer of labor valuation. In this curve it will be noticed that a slow increase in value is given from twenty-five to forty years old. I based this curve on the fact that unless the worker betters himself intellectually, whatever increase in value that he becomes to his employer will be only the result of length of service. After the worker becomes forty years of age, any longer service with the company could not qualify for increased valuation. From forty to fifty-eight years of age, the worker's value to the company from point of service remains stationary, after which the physical element enters into his value which brings about a decline in his value to the company until he strikes a low level which is in proportion to the value of the duties which he is able to perform. When an old worker ceases to be worth $12 per week, he should be removed from duty or placed on a pension.

The ends of curves *C* and *E* show a sharper decline than curve *A* because of the fact that curves *C* and *E* savor of an element of brain work and skill which does not require the physical qualifications of curve *A*. Consequently the period of decreased labor valuation does not start until some time after *A* and after declining slowly for a few years, suddenly drops to the low level. The class of workers represented by lines *C* and *E* are usually in a position to retire before the low limit has been reached.

The workers represented by curves *B* and *D* having once started their climb, do not encounter any great degree of stationary valuation, but on the contrary "carry on" until they retire or are called by death.

In summing up the whole proposition as to these curves on labor valuation, I have based my conclusions on the fact that the rapidity of absorbing knowledge is most pronounced in the first few years of learning and that it gradually tapers off until the highest value has been reached. Only technical training will reverse the curve and give it a sharp incline toward the pinnacle of increased returns.

I wonder what the moral effect would be to hang a large reproduction of these curves on the bulletin board in the office or shop with full explanations and headed, "Which of These Curves Represent You?"

Some Grinding Operations at the Marmon Plant

Fixtures and Methods Used in Finishing Gears, Valve-Stem Rollers, Valve Lifters, Steering Knuckles, Spring Shackles, Axle Housings and Connecting Rods

SPECIAL CORRESPONDENCE

THE accompanying illustrations give a good idea of the extensive use of grinding machines in building the Marmon car. Fig. 1 represents simply grinding the bore of a timing gear, and is only shown to illustrate the use of hardened pins for holding the gear at its pitch line in a draw-in chuck.

The grinding of the small rollers which go in the valve push rod is shown in Fig. 2. These rollers are held in the chuck *A* by means of the sliding washer, which is tapered sufficiently to force them against a suitable seat at the back end. This is an easily handled device for work of this kind.

Two of the grinding operations on the push rod itself are shown in Figs. 3 and 4. The method of holding for the first grinding operation can be readily seen by examining the driving dogs at *A* and *B*, Fig. 3. The dog at *B* has a push rod in place and is all ready to be placed in the grinding machine. The use of inclined tracks, shown by the machine, makes it possible to pass work from one machine to the next.

Another grinding operation on the push rods is seen in Fig. 4, where the ends are being ground square by a cup wheel. The rod is easily clamped in the small fixture at *A* and the operation proceeds very rapidly.

The somewhat unusual steering knuckle used in the Marmon car is shown in Fig. 5, where the portion which goes in the axle is being ground. This view shows the method of driving the knuckle for grinding.

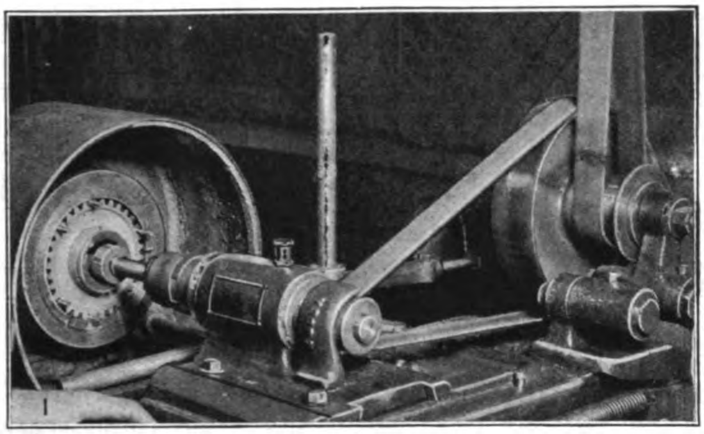
Another unusual grinding job is shown in Fig. 6, where a spring shackle is being held on a magnetic chuck while the side is being faced by a cup wheel. The projecting portion of the shackle has been previously ground between centers, as shown in Fig. 7.

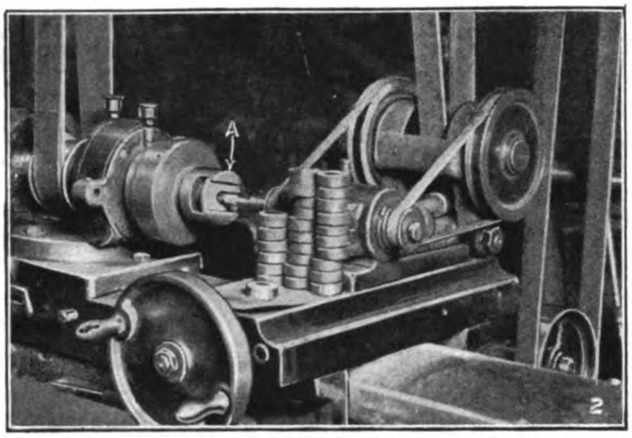
In Fig. 8 is shown how the sheet-steel rear axle housing is ground at the outer end for the wheel bearing. The end carries a plug which serves as a center.

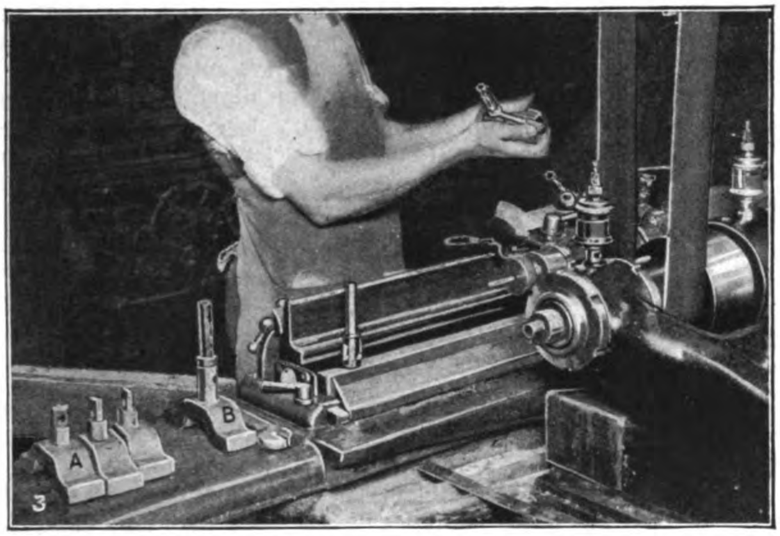
The connecting rod and cap joints are carefully ground to insure a solid metal-to-metal seat. The fixtures used and the method of locating and clamping can be clearly seen in Fig. 9.

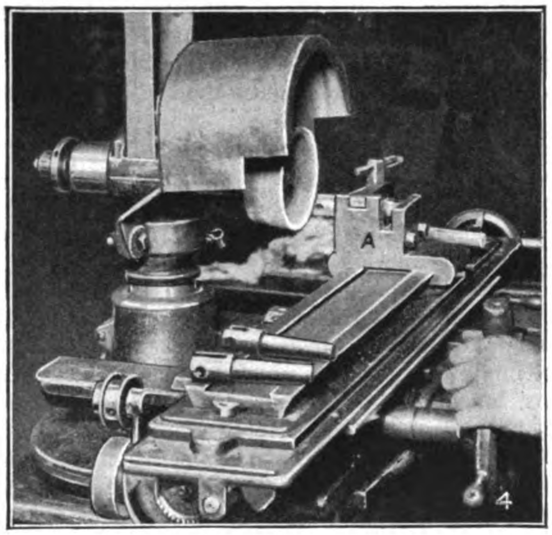
The valve rocker arm is being ground in Fig. 10, a simple fixture locating it and holding it in position. The cup wheel used has a long life on account of the depth of the cup.

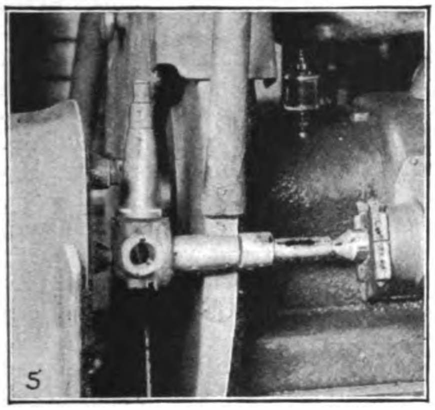
The foregoing examples are by no means all of the interesting grinding operations in the Marmon shop, but will serve to show a few of the ways in which grinding methods are utilized on general work.

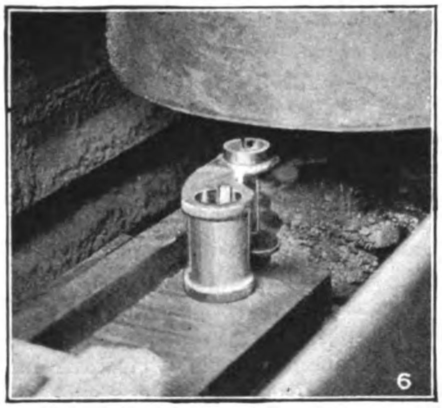


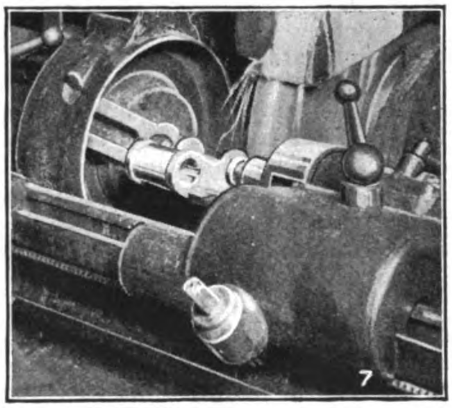


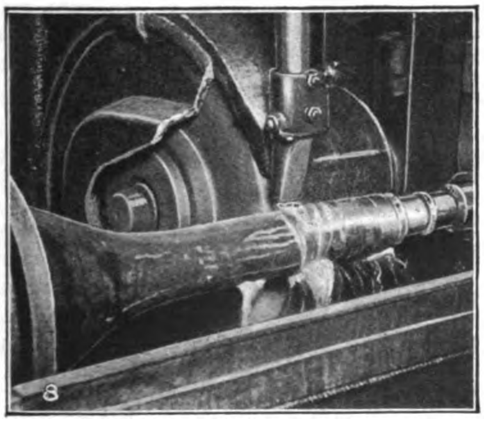


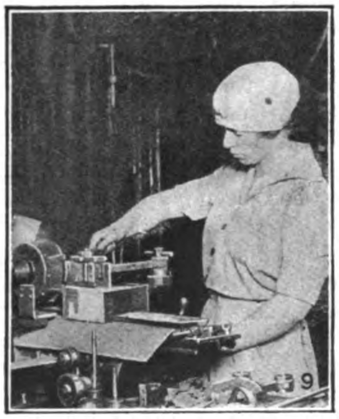












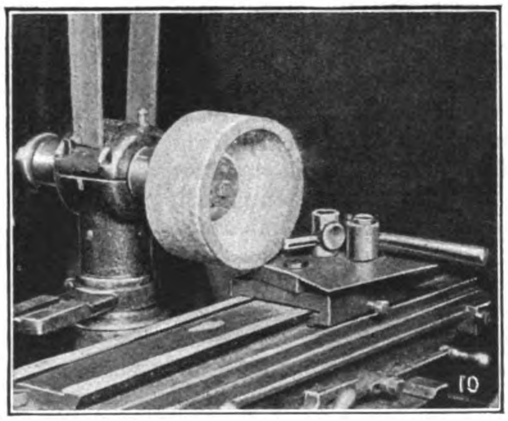


FIG. 1—GRINDING BORE OF GEAR. FIG. 2—GRINDING ROLLERS FOR VALVE ROD. FIG. 3—GRINDING VALVE RODS. FIG. 4—SQUARING THE ENDS OF PUSH RODS. FIG. 5—GRINDING THE STEERING KNUCKLE. FIG. 6—FACING SPRING SHACKLE. FIG. 7—GRINDING END OF SHACKLE. FIG. 8—GRINDING REAR AXLE HOUSING. FIG. 9—FINISHING CONNECTING ROD FACE. FIG. 10—GRINDING VALVE ROCKER

Standardization from the Consumer's Point of View

Standardization an Aid to Buying and Selling as Well as to Production—Different Kinds of Standardization—The Federal Specification Board

BY N. F. HARRIMAN
Technical Secretary, Federal Specifications Board
A paper presented at the National Exhibit of Chemical Industries, New York, Sept. 15.

In recent years, attention has been concentrated upon the material and mechanical side of production and distribution in industry. Physics and chemistry have revealed the secrets of raw materials and the modern manufacturer can determine the most suitable material and the most economical method of treating it to obtain the desired results.

One of the most modern sides of industry is standardization, now recognized as being of great importance to both producer and consumer. It is sometimes said that the benefits of standardization are mainly to the field of production.

This is actually not the case. They are quite as important to both the field of buying and of selling. In industrial standardization it is the consumer who is ultimately benefitted most but the immediate benefits are largely to the producer. It at once simplifies his work and enables him to produce what is required by the consumer cheaply and expeditiously. With lower production costs comes more extended use of the standard article. It is a law of economics that when costs increase substitutes appear.

NO BAR TO INITIATIVE

Objectors to standardization frequently urge that it would stifle initiative and progress and that the adoption of a standard prevents advance through improvements in the arts of manufacture. Of course, this is not the case. A standard should remain standard only until something better is developed but it should not be changed until justified from all points of view. Any given standard, to achieve its object, must be suitable for the intended use in the majority of cases. The exceptional case requires special consideration and actual perfection will never be attained. The economies and benefits of standardization, as applied to qualities of products and processes of manufacture, have been so thoroughly demonstrated within the past few years that they are entirely outside the argumentative field.

Standardization, like efficiency, is not an easy term to define. It is not always understood in its true sense and by many is looked upon with doubt and suspicion. The general idea of standards is not new but its application to science, engineering and industry has been developed within comparatively recent years.

Standardization may be defined as the unification of the methods and practices involved in manufacture, construction and industry, and all lines of endeavor which present the necessity of repetition work. It may be considered under several aspects.

Standardization of nomenclature enables buyer, seller, and manufacturer to use and understand the same language. It is very important that there be acceptable definitions of terms used in specifications and contracts. Purchasing is often done by persons who are quite familiar with the legal side of drawing up contracts but who are not familiar with the technical details involved. The efficiency of many purchasing officers is lessened by their lack of knowledge of the nature and names of the articles they are intrusted to buy.

Standardization of variety, or simplification, involves the elimination of unnecessary types, shapes, grades and sizes of manufactured articles. Waste in industry is largely due to on over-multiplicity in the number of products, as well as to inefficiency of process. Waste due to idle stocks of material and products through deterioration, obsolescence and capital charges carried, is large, especially with large stocks.

DIMENSIONAL STANDARDIZATION

Dimensional standardization ensures ready interchangeability of supplies, and the proper inter-working of parts which may be manufactured or assembled by different manufacturers.

Standardization of specifications and methods of test puts bids on as easily comparable basis, promotes fairness in trade competition, and ensures the proper grade of material for a given use.

The amount and intensity of standardization work now being done all over the world is surprising. One continually hears of "mass production" and the statement that the extensive introduction of it into industry, through standardization, is an economic necessity. National industrial and engineering standardizing bodies have been formed and are now functioning in fifteen of the most prominent nations of the world. Germany has been especially active in dimensional standardization, while the efforts of the British and American standardizing bodies have been directed more particularly toward matters concerned with purchases and contracts, such as specifications for materials, performance of machines and devices, methods of test, etc. A notable exception to this general statement is the dimensional standardization work of the automobile industry in this country.

MANY APPLICATIONS

From a broad viewpoint, standardization may be applied to materials, methods, products and uses.

Materials—The raw materials used in the manufacture of a product must be of standard and uniform quality, if the process of manufacture and the grade of the product are to be maintained. Sometimes it costs a little more to adhere rigidly to definite standards for raw materials, but the economies effected offset this.

Methods—A product made continuously from standard grade material more readily permits standardization of each step in the process of production. This is attained by the adoption of the one best and most economical method of doing each thing as taught by

plant and engineering experience, and making it standard practice.

Product—A standardized product, made to definite specifications, permits an output to the maximum uniformity possible within the limits of manufacturing skill. A uniform product made and sold continuously permits a steady production schedule, building up stocks during periods of low demand and depleting them during periods of high demand. On the unstandardized basis, the only alternative is to follow the "feast and famine" method. The definitely standardized product is manufactured to meet particular wide needs, according to definite specifications, and is constantly tested to ensure its being up to standard grade. The ordinary purchaser is not an expert on quality of supplies, and in many cases the quality can be lowered and he would be none the wiser until the material is put into service.

Uses—One type, shape, grade or size of an article will not meet all the requirements of the consumer, neither is it desirable to have such an extensive variety that the differences are small and meaningless. The ideal condition is to have just enough variety to meet all the real needs with no overlapping. Sound industrial economy demands the elimination of the special or little used product and its substitution by the standard or most widely used and most efficiently produced goods.

Specifications Standardized

Standardization of specifications is the most important phase of the subject, from the purchaser's viewpoint. It is the first and most essential step in the economy that arises from the purchase of materials or supplies in large quantities and is a necessary factor in the improvement of the quality of materials purchased and the adaptation of quality to definite uses.

The specification is the common meeting ground for the manufacturer, dealer and user and it is at once a statement of the users needs and what the maker is required to supply. Purchase by competitive bids on specifications is preferable to purchase on sample. The latter method implies that each bidder's product must be considered independently and it is often a very difficult matter to decide between different combinations of quality and price. The specification should include limiting values for the properties necessary to meet the required service, with proper tolerances. A correct specification is one which enables bidders to know exactly what is desired or required and what procedure the purchaser will follow to satisfy himself that the specification has been complied with. Defective and incomplete specifications, whether due to compromise of quality for temporary economy, or through lack of data, should be replaced by those in which the best magnitude of each property involved is so specified as to predetermine the definite quality best meeting the need. There is a growing appreciation of waste in industry due to the use of defective and improper materials.

To determine the value of any material for a given purpose, its properties must be measured, assuming that the proportion upon which its use depends are known and are measurable. The testing of materials may prove a needless waste of time, energy and money unless due consideration is given to the nature of the tests applied, the conditions under which they are made and the interpretation of results. Quality may be determined directly by a service test, indirectly by a test under simulated service conditions, or still less directly by a laboratory test of individual properties upon which the quality is known or assumed to depend. These may vary from a simple visual inspection to an investigation involving laboratory and technical work of the most difficult and precise nature. Friction and controversy between buyer and seller often arise as to the question of facts concerning the results of tests, especially when different methods or different equipment are used. Standardized methods of test consider all of these conditions, and are a necessary part of an ideal specification for a material or a manufactured article.

The United States Government is probably the largest purchaser of materials and supplies in the world and the greatest impetus that could be given to standardization from the purchaser's point of view would be for the Federal Government to adopt standard purchase specifications for the more important materials and supplies purchased by it. This has recently been initiated by the establishment of the Federal Specifications Board, in the office of the Bureau of the Budget, which has brought together the experts of the various departments. As a result specifications representing the best commercial and engineering practice are being selected for the use of all departments and bureaus alike in the purchase of supplies.

The selection and adoption of specifications or standards, without due regard to the manufacturing problems involved, would be equally as serious as for manufacturers to establish standards without a careful consideration of the needs of the purchaser. In the selection of specifications for Government use, the Federal Specifications Board is co-ordinating these two interests, and the standards adopted will eventually be used for all Government purchases. This procedure will undoubtedly serve as a model to be followed by corporations, municipalities, States and the general public.

With many large corporations, the standardization of purchases, and the resulting simplification of store stock varieties of materials offer a fertile field for economy. The purchasing officer with a technical knowledge of materials and supplies, together with a knowledge of standardization principles, is best equipped to secure maximum results.

Change of Product

By A. W. Brown

There comes a time when the market for a product slumps or disappears. Hoop skirts are an example of such products. Cigars seem to be yielding place to cigarettes. Detached cuffs for men's shirts have almost disappeared from shops and laundries. Where are the bustles of yesteryear? And the man's long boots? And mittens, tall white beaver hats, "bone-breaker" bicycles, quill pens, letter-copying presses, bar fixtures. and dozens of other things?

So almost every factory may have to confront compulsory change of product. In emergencies, as in war time, they find it advantageous to drop their regular line and take something entirely different. In the Great War the stove foundry turned out shells while the type-writer plant made machine-gun parts.

It is then well for every factory to have a card up its sleeve and know what it would make for a change if its line of product went out of fashion or use. This is entirely independent of so-called "chink-in work," taken to fill up dull times in the regular line.

Ideas from Practical Men

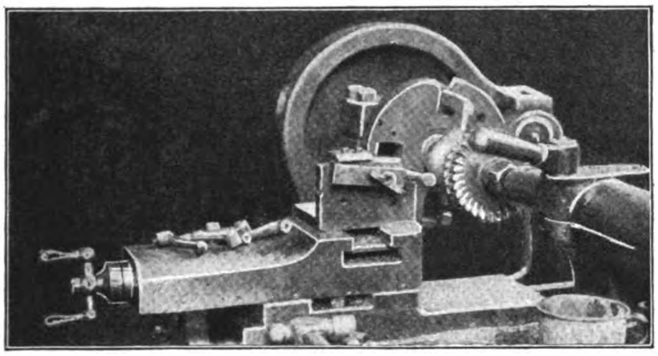
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Straddle-Milling in the Lathe

By Henry M. Clary

The job here described was observed in the plant of the Central Machine Co., Detroit, Michigan. A large lot of small drop forged steel accelerating levers came in to be milled on both sides of the small end, the finished dimension being $\frac{5}{16}$ in. As all the milling machines were in use, a pair of side milling cutters was mounted on a nut arbor and put into an old Rahn-Carpenter lathe.

A pin was then screwed into a small angle plate, the



STRADDLE-MILLING IN THE LATHE

pin being of the diameter of the hole in the large end of the lever and so located that when the angle plate was bolted to the toolrest, the lever would be held in the position shown in the illustration. A block and thumb nut on a stud supplied the necessary clamping action. As the pin that held the lever was not over $\frac{1}{8}$ in. long, one or two turns of the nut were sufficient to allow the work to be changed. A block attached to the end of the angle plate nearest the cutters served as a rest for the lever. The operator fed the work in and out by hand and obtained a production of 100 per hour.

The Art of Milling in 1750—Discussion

By Matthew Harris

In an article under the above title by L. L. Thwing appearing on page 267 of *American Machinist*, Mr. Thwing draws the conclusion that the milling machine and cutter were the invention of a clock maker. By the same token it was a clock maker who devised the first universal milling machine, covering the principles of all such machines in use today.

Joseph R. Brown, originally a clock maker of Providence, R. I., invented the universal milling machine about 1861 or 1862. According to Professor Roe's "English and American Tool Builder," the first machine was built and sold to the Providence Tool Co. for making twist drills to be used in drilling the holes in percussion nipples for muskets. This was in 1862, at which time the Providence Tool Co. was engaged in a government contract for Civil War muskets.

An Ordinary Rotary Table as an Indexing Device

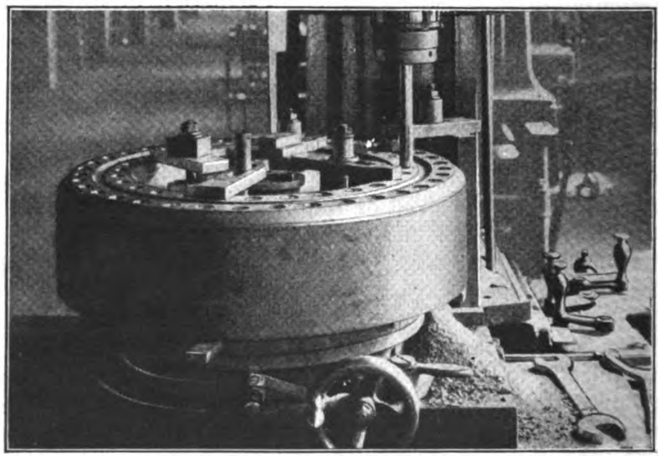
By J. M. Henry

The boring of a double circle of holes in a grinding fixture necessitated the use of an indexing device to locate the holes properly. The ordinary vertical milling machine, with rotary table, is neither large enough to handle the job, nor do the graduations on the table lend themselves to the required spacing. In addition to these reasons, the spindle of the machine is not considered sufficiently accurate as, although the spacing is not arbitrary to a minute degree, the holes when bored must stand perfectly square with the surface of the jig.

We found, by trial, that the handwheel of a Brown & Sharp rotary table in making one turn moved the table through an arc of three degrees. The outer circle of the work contained 36 holes and the inner one 28 holes, involving $3\frac{1}{3}$ and $4\frac{2}{7}$ turns of the handwheel respectively. We did need, therefore, to reduce our calculations to minutes of arc, but only to provide for thirds and sevenths in the rotation of the handwheel.

The logical solution of this was to divide the handwheel into 21 equal spaces and this was done by placing it upon an arbor between the indexing centers of the milling machine and using the regular dividing head.

A stationary mark for a point of departure was pro-



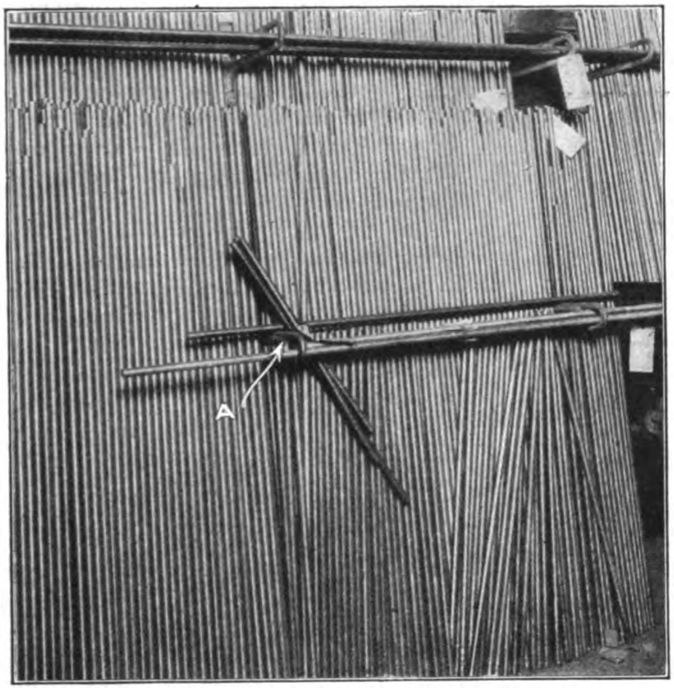
AN IMPROVISED INDEXING DEVICE

vided by clamping a suitable strip of sheet steel under a convenient screw head and scribing a line upon it, when the device was ready for service. The spacing for the holes of the outer circle was made by turning the handwheel 3 turns and 7 lines, while, for the inner circle, 4 turns and 18 lines were required. The holes were spotted, drilled, bored and reamed to a limit of accuracy in diameter of 0.00025 in. upon a Pratt & Whitney Jig Boring machine.

Storing Screw Machine and Similar Stock

By Herbert Crawford

The illustration shows a convenient method of storing screw machine stock in a small space and with safety. The loops shown are welded to flat bases which are bolted to the plates of the rack. The loops have cross bars or partitions, as can be seen at *A*. The stock is



STORAGE RACK FOR BAR STOCK

placed on end against the rack and, when the bars are all in place, one or two bars are slipped through the loops to tie the bars in position and prevent their being pulled over forward. This rack is in use by the Hoover Suction Sweeper Company at its plant in Canton, Ohio.

Improvised Forms for Coiling Pipe

By I. B. Rich

Here is a pipe bending or coiling kink I ran across in the Griffith Machine Works, Los Angeles, some time ago. This shop does much experimental work and this job had a long pipe, coiled into a sort of a bed spring effect as shown in Fig. 1. The trick was to coil the pipe with-

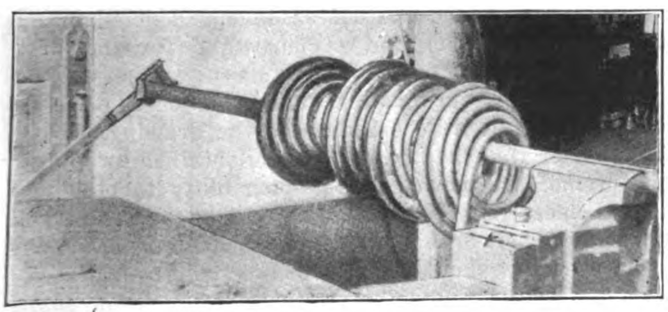


FIG. 1—THE COIL AS WOUND

out kinking it and to have the coils uniform in diameter and appearance. Like many difficult jobs, it was comparatively easy after you realized the correct way to go about it. Fig. 2 shows the way it was done.

A wooden form was turned up of the proper diameter to make the desired shape and the outside had a spiral groove to match the pipe. These forms were made in two parts, as at *A* and *B*, the two halves making a complete double cone. The cones were placed on a mandrel to center them and the pipe wound around them as in Fig. 1. The coils were then spread enough to let half the form come out, as in Fig. 2, and both halves were removed through the same opening. The coils were then sprung back and there was no trace of the forms having been removed.

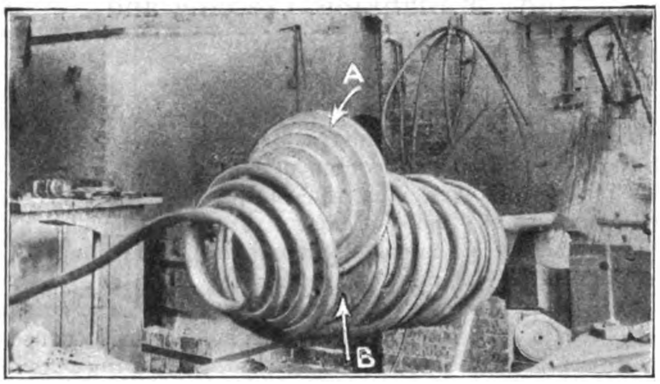


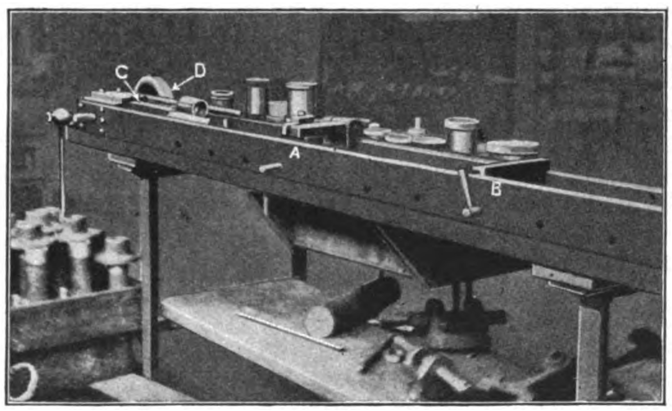
FIG. 2—REMOVING THE FORMS

Pressing Bushings on Long Rods

By Frank C. Hudson

Here is a useful little press which the Lucas Machine Tool Co., Cleveland, Ohio, uses to press bushings on the ends of long rods and screws. Instead of tapping the bushing on with a lead hammer and sometimes springing the screw, the screw is laid in suitable bearings, at *A* and *B*, and clamped fast. Then the bushing is placed on the end and forced on by a ram at *C*.

The ram is actuated by a pinion on a shaft which carries the wheel *D* on the other end. For rapid



PRESSING BUSHINGS ON SCREWS

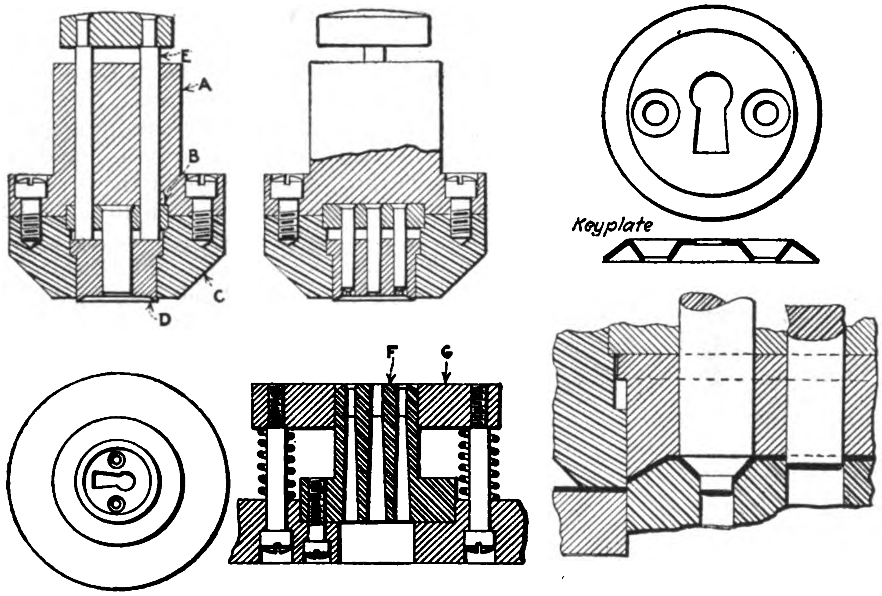
traverse the operating handle is placed on the pinion shaft and moves the gear direct. For power in forcing on the bushings another shaft is provided which carries a pinion meshing into an internal gear cut inside the wheel *D*. This arrangement gives a powerful gear ratio and has the advantage of operating in the same direction as the direct drive, which avoids confusing the operator. A ratchet wrench is used when desired, making it easy to get the pull at convenient angles. The holes in the side of the press show different positions at which the clamping blocks can be placed.

Die for Blanking, Piercing and Countersinking

By S. A. McDonald

In the accompanying illustration is shown a small set of tools for blanking, piercing and forming a keyplate. The plate is blanked from the strip, the holes pierced and countersunk, and the edge of the plate beveled at a single stroke, a complete plate being thrown out at each movement of the press.

The die is of the inverted type and is constructed as follows: The machine steel die holder *A* is turned to fit the press slide and contains the piercing-punch



DIES FOR MAKING KEYPLATE

plate *B*, the blanking die *C*, and the knockout *D*. The double knockout stem *E* extends through the die holder and piercing-punch plate and rests on the knockout so that it moves with it.

The punch *F* is located in a plate which is bolted to the bolster of the press. The stripping ring *G* is secured around the punch by the filister-head screws which have the pressure springs on them as shown.

Two unusual features of this die are that the cutting edge of the punch is beveled to 30 deg. and the holes for the screws are countersunk to suit the angle of the flat head screws. This does not seem to affect the cutting of the dies.

An enlarged sectional view of the cutting edges just as the key plate has been struck is shown to the right.

The die operates as follows: When the die descends the countersunk holes are formed and as the movement continues, the screw holes are punched and at the same time the blank is cut. As soon as the blank is cut the knockout comes up against the plate *B*, so that the key plate is bumped on the punch. This sharpens up the angle of the bevels and gives the key plate a neat appearance.

On the up-stroke the stripper ring strips the stock from the punch and when the die nears the end of its stroke the knockout bar of the press forces the knockout stem down in the die against the knockout pad *D* and thus strips the key plate off the three punches.

As the press is inclined, the work falls down a chute through the back of the press while the scrap punchings pass through the bolster to a scrap can.

Instructions to Workmen —Discussion

By T. Taylor
Chelmsford, England

In the *American Machinist*, page 954, Vol. 56, was published an article under the above title by C. J. Morrison. In it the author gives an instance of a workman who, by following instructions strictly to the letter, as given on the operation card, did not produce work as economically as might have been the case had the workman and shop superintendent been given the liberty to use their discretion and experience. The above example is not confined to America as I have experienced it since the war in one of the largest motor car works of England.

One of my jobs was machining brass magneto-platform castings, the sides of which must be milled central with the bore of the flange, providing true alignment with the magneto spindle. The first operation on the card issued by the planning office, called for boring and facing the flange. For operation two, the casting was bolted on the fixture on the milling machine table, locating the work from the bore. The sides and bottom were then milled, the workman trying to mill the two sides an equal distance from the center of the bore of the flange by repeated trial cuts and the use of gages. The result was that nearly always one side or the other was a few thousands out of center, although the instructions had been carefully followed throughout.

The next operation (not on the operation card) was closing in the sides in a strong vise to provide a little metal to rectify the job, known in the midlands as "doing Brummagen." Upon my suggestion to the shop superintendent that a better method would be to reverse the operations and first mill the sides and bottom, secondly bolting the casting on a jig, locating it from the sides, then bore and finish on a capstan lathe, the superintendent quite agreed that such should be the method but that unfortunately his hands were tied by the operation card issued by the planning office, under the control of the chief of that department, who has full authority.

I submit that the system of independent planning offices does not work for efficiency and for the shop superintendent or foremen to offer suggestion to the planning office is quite as disagreeable a job as offering suggestions or a little criticism to the drawing office.

I consider that best results can be obtained by giving the foremen the power and responsibility to plan the general operations of a job, subject, of course, to the approval of the works manager or superintendent. Tool layout and jigs should be left to the tool room department. With bad planning systems, foremen in some large works are nothing better than glorified clerks, which is very discouraging to men of initiative. What is more important, the firms concerned are ignoring a valuable asset. When a better way is seen, there is no wisdom in performing a job in an inefficient and expensive manner, simply because the man who first planned the work did not see all the possibilities.

Milling Clearance on Combination Center Drills

By King J. Bogardus

In the small machine shop where a great deal of centering is done, little difficulty is experienced in making a center drill, as far as turning the blank and milling the two grooves is concerned, but when it comes to filing the clearance it is found to be difficult and unprofitable.

The blanks can be turned in any lathe very rapidly by placing a center drill in the chuck or collet and setting the tool in correct position for turning, as illustrated in Fig. 1. The crossfeed will not have to be disturbed, and by moving the handle operating the carriage traverse by hand the angle and diameter can be turned with the same movement. Feeding with the compound rest handle, having the rest set on an angle of 1 deg., instead of feeding with the carriage handle, will make a better blank, due to clearance on the body of the drill.

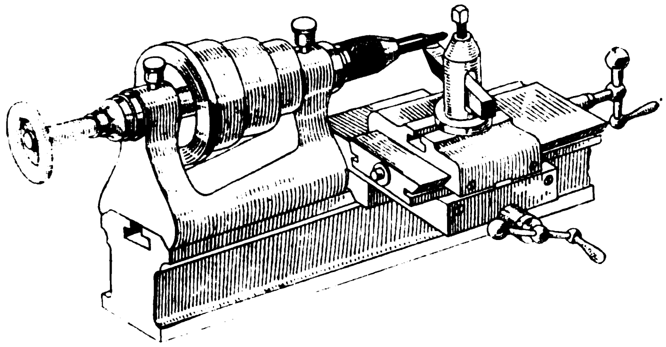


FIG. 1—TURNING THE BLANK

When the blank is ready for milling the clearance there may be rough-turning marks as the result of not feeding on the angle with the compound rest set at 30 deg., and there may also be a ragged edge on the flutes after milling; but all of these will be removed when the clearance is milled, and the milling will also correct the angle if necessary. The set-up for milling the clearance is shown in Fig. 2.

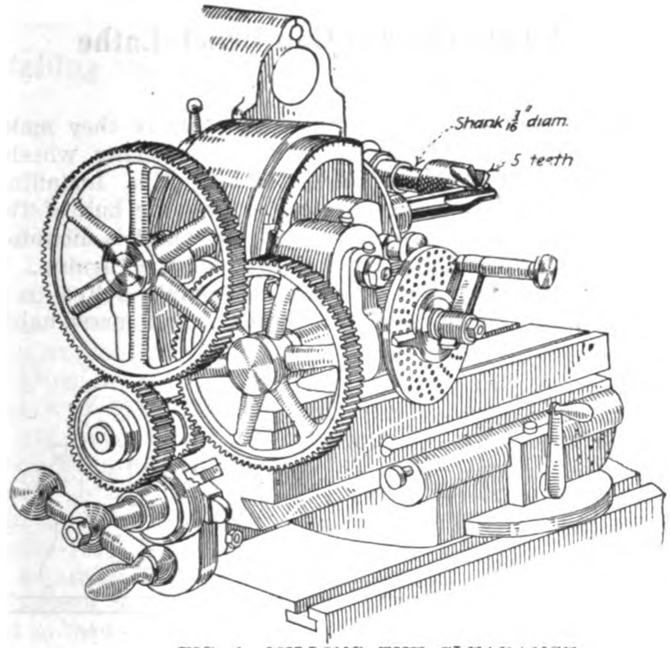


FIG. 2—MILLING THE CLEARANCE

Holding the cutter in the chuck of the milling machine spindle and the drill blank in the chuck of the dividing head, we are ready to mill this clearance. As most milling machines cannot be geared for milling spirals of shorter than $\frac{5}{8}$ in. lead by gearing to the worm on dividing head, the gear is placed on the spindle of the dividing head which is revolved, feeding the table by turning the handle of the dividing head by hand.

Improvised Tools in the Oil Country

By Frank C. Hudson

In turning rods for oil pumps, which are about 6 ft. long and perhaps $1\frac{1}{2}$ in. in diameter, the device shown in Fig. 1, has been found very useful. It consists merely of a plate *A* supported by the two substantial arms *B* and *C* bolted to the side of the saddle of the lathe carriage at *D*. The plate *A* carries two cutting tools on the front side, and three guiding rollers on the face shown. This device is in reality an improvised follow rest with roller guides, and has proved very satisfactory for work of this kind.

Another device in connection with oil pump work is shown in Fig. 2. This is an attachment for a vertical drilling machine, used in turning the pump valve cage, shown in Fig. 3. The device consists primarily of the plate *A*, which is supported on the drilling machine table *B* by means of sleeves *C* and *D* held in position by the through bolts shown. The plate *A* carries the guide *E*, through which a special spindle, driven from the spindle of the drilling machine, works. The spindle carries a collet *F*, in which the stock *G* is held. Bolted in position on the table *B*, is a base carrying the combined drilling and boring tool *H* and also a tool slide with a toolpost *I* for turning the outside of the cage. The toolpost *I* can be adjusted to or from the center, so as to regulate the depth of cut, and also to turn straight or taper, as desired.

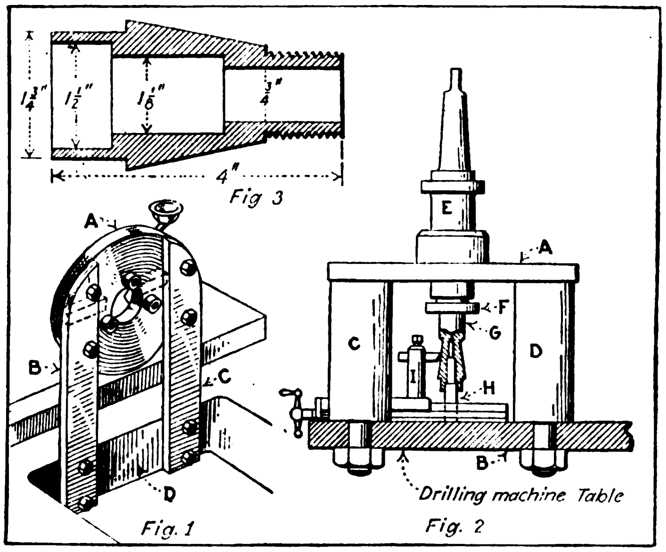


FIG. 1—ROLLER REST FOR TURNING PUMP RODS. FIG. 2—TOOL FOR TURNING AND BORING ON DRILL PRESS. FIG. 3—THE PIECE TURNED

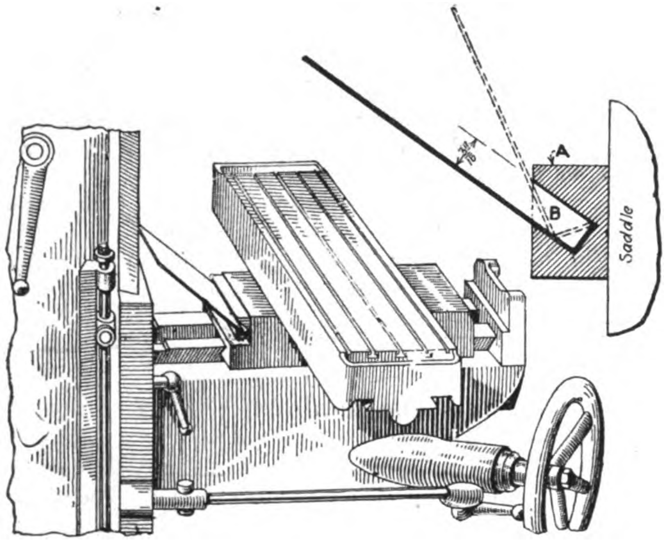
This is simply one of the many devices by which a vertical drilling machine can be used for turning, and was designed only because it was impossible to obtain a suitable turret lathe at the time. It has since been discarded but served its purpose well when it was necessary. These devices are from the shop of the Houston Pump & Supply Co., and were made under the direction of the guiding spirit, Mr. Thomas. The approximate dimensions of the piece turned are shown in Fig. 3.

Chip Catcher for the Milling Machine

By A. W. Freeman

The device shown in the sketch provides a means for keeping the saddle ways on a milling machine free from grit and shavings, thereby eliminating the cause of a great deal of trouble and wear to the machine.

The holder *A* was made from ½ x ⅜-in. key stock and fastened to the inner side of the saddle, extending over each side of the knee about 2 in. The slot *B*, 3/16 in. wide by ¼ in. deep, was milled its entire length. Three pieces of sheet metal of 20 gage were cut in different widths from 4 to 10 in. and long enough to overhang either side of the knee. One edge on each piece was turned up to approximately fit the milled slot, as shown.



CHIP GUARD FOR MILLING MACHINE

By placing the metal plates in the holder, flanged side up, the flange will keep the plate from dropping down beyond the angle of the slot, which is about 25 deg., and will also allow it to raise up as shown by the dotted line when it comes in contact with the column. The different width plates are used at different settings, depending on the position of the saddle.

Re-Echoes from the Oil Country —Discussion

By J. T. Towlson

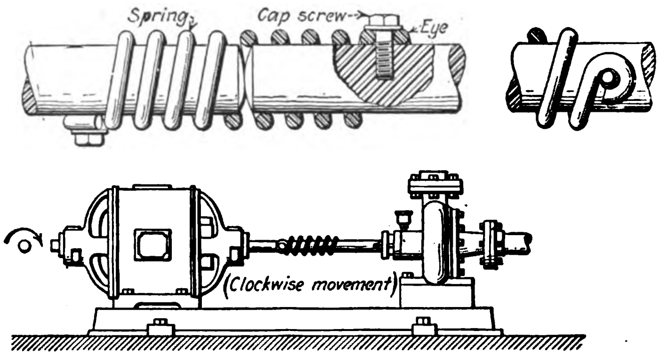
In an article under the above title by E. W. Tate, and published on page 963, Vol. 56 of *American Machinist*, Mr. Tate refers to the way an inside thread was cut on the end of a 40-ft. drill shank on a lathe with a 24-ft. bed. It was a great performance and showed what could be done when necessity demanded.

I have cut threads on bridge suspension-rods 40 ft. long in a lathe having a 16-ft. bed. The work was 4 in. in diameter and the threads were 2 per in. The length of the threaded part was 24 in. It was permitted to waste 1 in. of the rod, and three-quarters of this inch was used for chucking. The work was run in two steadyrests, one on the lathe bed and the other on blocking further along. The thread was started at the required position on the rod and, being right-hand, was cut toward the chuck. After the threading was finished, the rod was cut off at the chuck end, using a ¼-in. parting tool.

A Shock Absorbing Spring Coupling

By Joe V. Romig

When a motor is direct connected to a machine the armature shaft of the motor and the drive shaft of the machine should be connected by a flexible coupling to allow for any deviation in alignment. The accompanying illustration shows a flexible coupling which is merely a spiral spring with an eye at each end for attaching to the shafts by cap screws.



A SHOCK ABSORBING SPRING COUPLING

The inside diameter of the spring should be slightly larger than the diameter of the shafts to absorb the starting shock. In applying the spring it should be stretched so as to be under tension when fastened in place and thus keep the abutting ends of the shafts together. Care should be taken to have the eyes on opposite sides of the spring and to have the ends of the shafts slightly rounded.

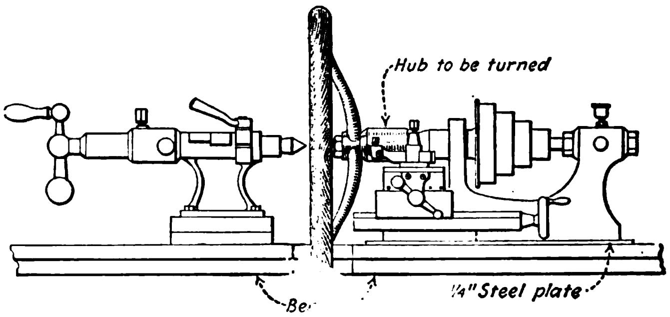
In addition to its ease of application and its smooth running qualities, this type of coupling is the cheapest that can be applied.

A Left Handed Gap Bench-Lathe

By Frank C. Hudson

In a small automobile repair shop where they make a specialty of putting on locks for steering wheels, I found the little lathe illustrated herewith. Installing the locking device necessitates turning the hub of the wheel to fit the locking sleeve, so the wheel is mounted in the improvised gap lathe shown, for the turning.

The headstock and tailstock are simply bolted to a substantial bench, the two heads being presumably somewhere nearly in line. A gap is cut in the bench so as to allow large steering wheels to swing, as shown. The headstock has a ¼-in. steel plate between it and the bench and on this plate the small slide rest is mounted, as shown. The slide rest carries the tool for turning the wheel hub. It will be noted that the headstock is on the right.

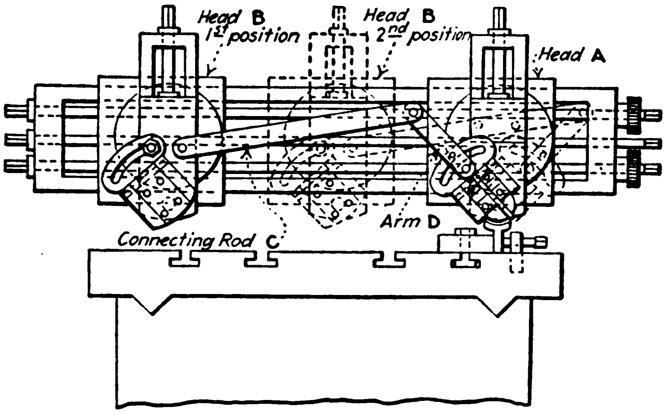


IMPROVISED GAP BENCH LATHE

Generating a Radius on a Planer

By Louis Hornbuger

We received a job the other day, 12 ft. long and 2⅛ in. wide, to be machined with a 1¾-in. radius. The specifications called for accuracy and high class finish. Due to the length of the work, it was impossible to mill it except by making several settings which would not be good practice. The next thought was to do the work on the planer which we rigged up as shown in the illustration.



HOW THE PLANER WAS RIGGED TO PLANE THE RADIUS

Having an extra tool slide which had been discarded we milled it to clear the work and mounted it on head *A*.

After making connecting rod *C* and arm *D* and attaching them, as shown in the sketch, to heads *A* and *B*, the head *A* was tightened on the rail central with the work. By means of power feed, head *B* was traversed from first position to second position and this moved the clapper block on head *A* through an arc, completing the operation and making a first class job.

Catching the Thread by the "Jump" Method —Discussion

By J. T. Towlson
London, England

In an article under the above title by B. A. Donley, published on page 970, Vol. 56 of *American Machinist*, Mr. Donley boosts the jumping method, whereas the writer, if he caught one of his men or boys acquiring such a disreputable practice when correct means were easily available, would himself do the jumping by way of having no further use for "the jumpers" services. Threads of both fine and coarse pitches have been cut for generations and in hundreds of shops without reverse belts, without dials and without "jumping" the thread.

There is no need of going to railroad shops hundred of miles from anywhere to discover an absence of dials and reverse belts, for ninety shops out of a hundred in England possess them not. The fact is that such helps to the amateur were a war measure and an assistance to the war mechanics who escaped service by working on munitions, though they had never worked in a machine shop before. Bona fide lathe hands do not need these helps, neither do they stoop to the "jumping" method. They just run the lathe and, after taking the first cut on the thread, they put a chalk mark on the face plate and another on the gear on the lead screw and then run the carriage back to a fixed position.

By always stopping the carriage at the same place on the return, and revolving the spindle until the chalk marks on the faceplate and gear are in the same relative positions as when made, the tool will be in the proper location, the half nut can be closed on the lead screw and the cutting of the thread proceeded with. The value of the reverse belt, as applied to particular cases, is by no means belittled by what has been stated above. There are some jobs such as cutting worms for wheels of diametral pitch when neither the chalking or "jumping" methods are practical. Such pitches are either multiples or fractions of 3.1416 and pitches that are sub-multiples of this dimension are rather fine fractions.

These threads *can* be cut by the chalking method but there is a risk and a waste of time in bringing the marks to their relative positions. Obliged to cut many hundreds of worms having diametral pitches of 4, 5 and 6, I made lead screws of 6 diametral pitch for two of our lathes. With such screws I was able to cut multiples or fractions of 3.1416 with the ordinary change gears and by the chalking method.

Blue Printing from Typewritten Sheets—Discussion

By Chester G. Salmon

In an article under the above title by H. Broome, published on page 271 of *American Machinist*, Vol. 57, Mr. Broome lays great stress on the importance of using a special ribbon for the purpose of writing on the copy for making plue-prints. We have in our factory about 35 data and part number books which are continually being revised and additions made, new prints being issued accordingly. The data sheets being mostly drawings were, of course, on tracing cloth but the part number sheets were quite a problem as we didn't care to print the part numbers on tracing cloth by hand. It would take up too much space and would almost require the services of one man changing the sheets and making additions, so we tried the tracing cloth in the typewriter, but with little success. Then we tried some Japanese tissue paper put out by the Remington Typewriter Co., with and without a carbon reversed. We found that the tissue with the carbon reversed, worked fairly well but we were not satisfied with it. It had to be run too slowly through the blue-print machine to get the best results.

We have some prepared oil that is sold by the Eugene F. Dietzgen Co., called "Transperento" which we use on van dykes, etc. to lighten their density. We tried this oil on the tissue paper after typing, got the very best results from it, and have been well satisfied with our success. We put the oil on the paper with a brush and then wipe off the surplus with a cloth. allowing the oil to dry before printing, and find that the paper has the greatest possible degree of permanent transparency.

Summing up, nothing out of the commonplace is needed except the oil and that can easily be obtained from almost any dealer of drafting supplies. In case only a few blue-prints need to be made from the original, gasoline or benzine can be used, but they evaporate quickly from the paper and leave it in the same condition as before. The oil can be used on heavier grades of paper but not with the best results. Sketches can be made on paper and then oiled and good blue-prints obtained. It would be advisable to use ink or a very soft pencil in making sketches.

Editorial

Charity Begins at Home—or Should

It would seem that a concern doing weaving should consider that weaving equipment has first call on whatever money is to be expended for improvements. Similarly, one engaged in spinning should make its investments primarily in spinning machinery and equipment, and not for a new and improved coal handling device. Again, a concern which manufactures its products with the help of machine tools, should give these machines first claim on investments.

Strange as it may seem, this is not the case in a great many, perhaps, the majority, of instances. The old lathe is still good enough, much too good to be replaced so long as it is in production, and, of course, it stays in production so long as its holds together or can be made to hold together by patching and repairing. The company cannot afford, just now, to spend $3,000 to replace a tool which is still active.

And yet, this same company is spending $50,000 on a new power plant because it is a good investment. It will borrow the money, if necessary, because a 10 per cent return has been promised.

This picture is not overdrawn. The cause of this peculiar phenomenon is possibly that the power plant promises a saving of coal, something tangible, whereas nobody has the temerity to guarantee a definite return on the investment when improved machine tools are bought. The machine tool builder does guarantee the performance of the machine, but he is not in position to translate the increased output into dollars and cents.

The man who sells the engine for power plant in general can point out that the saving in coal will be 3 tons a day, that this coal costs $6 a ton, and that there are 300 working days a year, so that the total saving will be $5,400 per year. This admits of an investment of $54,000 with a return of 10 per cent. As the outfit he tries to sell calls for $50,000 only, he has a good proposition and is very apt to convince the prospective customer.

Such a simple procedure is not possible when machine tools are sold. There is the operator to be considered, and besides, many different jobs are done on this one machine. Moreover, the real values of these jobs are not accurately known and it is difficult to compute the amount of savings due to the new machine. There are several other reasons, perhaps, and yet, it seems to us that the owner of a machine shop should first look after machine tools and similar equipment, that the owner of a drop forge shop should first consider his hammers, his presses and furnaces, and that, generally speaking, charity should begin at home.

On the other hand, a machine tool machine needs to be but litle more productive to give 10 per cent on the investment. To save $200 a year with a $2,000 machine should be easy. It might even be done though the new machine is in no way different from the old one, just because it is new and requires less attention and repairs and interests the operator, much as a new automobile puts the chauffeur on his best behavior.

Give Them a Long Vacation

The statement in this morning's paper that President Harding believes the members of Congress should have a long vacation is very welcome. Mr. Harding is quoted as having said that the country is fed up with Congress and its actions and he is absolutely and entirely correct, so far as this Congress is concerned at any rate.

It seems as though the national legislators had been in practically continuous session since our entry into the World War. Of course they have not, but, if the extent to which they have irritated the average citizen is any criterion, they might as well have been.

With Congress out of the way business can proceed more freely. No uncertainty as to pending legislation hangs over business men and they are assured of at least a fair breathing space before more laws can be passed. Bad as the taxation and tariff acts may be, they are at least definite and steps can be taken to meet their requirements.

As usual the majority leader has pointed with pride to the number of bills passed, something over four hundred. If quantity were the only requisite no fault could be found, but when it comes to quality—well, just consider how many obsolete, worthless and unenforceable laws there are on the statute books. One of the obvious defects of our form of government is the ease with which such laws can be passed. Truly we have a "government of laws."

How our problems would be simplified if only a Congress could be assembled to repeal the unnecessary legislation which encumbers the business of living. But what a Herculean task it would be!

China Trade Bill Becomes a Law

During the past week, the President signed the China Trade Bill. It is now a law after a campaign for its enactment which lasted nearly three years. Unfortunately, with tariff legislation occupying the foreground in national affairs, the purport of the bill and the placing of it upon our statute books has not been accorded the publicity it properly deserves.

In brief, the bill is designed to aid Americans, desirous of engaging in commercial or industrial activity in China, by relieving them of a two-fold tax burden. Under the Hongkong ordinances, British companies, and their personnel operating in China, were exempted from corporate and personal income taxes in Great Britain. American enterprise was thus placed at a distinct disadvantage. Corporate taxes were paid at home and abroad. Upon the personnel sent out from the States was laid a similar burden.

Living in China even under the best conditions is far different from what it is in the States. The cost of housing, food and other necessaries, everywhere in the Far East, is exceedingly high. Conveniences for unmarried men, not to mention those with families, are trying even under the best circumstances. To lighten their burdens and those of their companies should be our first thought.

Editorial

What Should We Do About It?

We have before us a copy of the *New York Commercial* in which appears a lecture given by Mr. Floyd W. Parsons, Editor, *Gas Age Record*, before the Advertising Club of New York on Sept. 20. In this lecture Mr. Parsons points out and condemns the fearful waste of materials of which this country is guilty. He goes so far as to say that, just as we are speaking now of the stone age, the bronze age and so on, so will future generations speak of the present era as the age of ivory domes. We have no fault to find up to that point for ivory is a nice, genteel material and quite valuable. But when he said a little later that it was established beyond doubt that we (in common with the rest of the inhabitants of the U. S. A.) were possessed of domes of solid bone, we sat up and took notice. We felt that we had to look a little further into this matter before we could accept the verdict.

The lecturer pointed out how much coal could be saved by using our water power, something which cannot easily be denied. He then went further and showed how we are depleting our reserves of iron ore. how the consumption of iron had increased since the beginning of this century and how it is still increasing. Copper also, Mr. Parsons claims is used at a rate which may exhaust the supply in a few years, while oil is already burned at a rate much beyond the rate at which it is produced in this country and this rate itself must exhaust the visible supply in a generation.

The picture is indeed a sad one. It reminds us of the lamentations of Jeremiah and also of Mark Twain when he said: Everybody complains about the weather, but nobody seems to do anything about it. (We quote from memory).

That's it. What is Mr. Parsons going to do about it, or what does he expect us to do about it? We are willing to obey orders if somebody is willing to give them and assume responsibility.

He does give orders about coal. He says: "Develop our water power," Good, we'll do that, we have already started. Truth compels us to remark at this point that, if we wish to utilize this developed water power, we'll need more copper than ever. Or is there perhaps a way to avoid it? Aluminum? Then we'll begin to exhaust that material. Oil is used almost entirely where water power can do no good, for automobiles, trucks, steamers, so that it seems as if the most promising way to save oil is not to use it. This method also goes for iron. There is at present no material which can take its place. But how can we live the life we wish to live without iron?

The trouble with articles and lectures such as Mr. Parsons' is that they are merely complaints. They are not constructive, they do not help. Of course we can cut down the consumption of anything by lowering our standard of living. We can even go back to the single stove in the home and perhaps family relations might be improved if all the members were sitting around it each night. We might become sturdier and hardier if all other rooms in the house were left cold. Maybe.

Candles made from the tallow of home butchered sheep may make electric light and its copper and even kerosene unnecessary. And, as we have butchered our own meat, the butcher does not need a delivery truck, which saves more oil. Also we do not need to call him up by telephone, which saves more copper.

Oh yes, we could, but would we?

The End of the Bonus

President Harding has justified the country's faith in his sound judgment by his veto of the so-called adjusted compensation bill, passed by Congress. At the same time, Congress has, by its action, added one more point to its score of mistakes. There seems little reason for doubt that most members of both Senate and House, who voted for the bill, did so with an eye to the votes to be gained by so doing. It is our feeling, however, that they were mistaken in their estimate of public sentiment and we have evidence to support our view in what happened at the primaries to some of the strongest advocates of bonus legislation.

Commendation is also due those Senators who sustained the President's veto. Perhaps they should be praised as much for their political acumen as for their support of an executive action which is undoubtedly for the good of the country. At any rate, they did a good job and American business men will breathe more freely as a result of the laying of the bonus specter.

Aside from the merits of the case as to whether or not ex-service men should receive a bonus, the bill, which has just been disposed of, was faulty in that it failed to provide means for securing the funds needed to carry out its provisions. It deserved its fate.

Just Suppose

Just suppose a big strong man, a giant of a fellow, were the employer of a number of men and wanted these men to turn out more work per hour and work more hours per week. Suppose that the men being unwilling, he fired them all and said to them:

"You are suspended until you make up your minds to work for me on my conditions, but don't you dare to go to another shop. If you do, I'll do everything in my power to break you and bring you to poverty. You have your job just as before, but I won't let you work at it and I won't pay you for it."

Now suppose some of the men, having no sense of honor, fairness, or decency go to the big man's neighbor, ask for and obtain a job and the big man, hearing this, knocks some of his neighbors down, kills one of them and burns the factory of another. Don't you think he is perfectly right and that no court should stop him with a fool injunction?

Nonsense, such things may be done by strikers but not by—

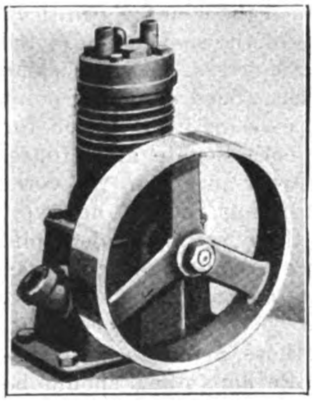
Well, but

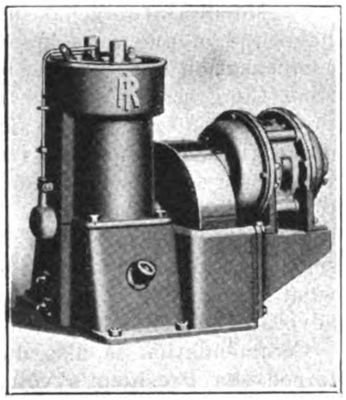
Just suppose.

Shop Equipment News

Ingersoll-Rand Small Vertical Air Compressors

A line of small vertical air compressors known as Type 15 has recently been brought out by the Ingersoll-Rand Co., 11 Broadway, New York, N. Y. At the left of the accompanying illustration the plain belt-driven machine is shown, and at the right the self-contained electric-motor-driven outfit. The machine is built in four sizes in either style. With the motor drive, the compressor may be driven by means of a pinion and





INGERSOLL-RAND VERTICAL AIR COMPRESSORS

internal gears, or by a short belt. Both motor and compressor are mounted on a common sub-base, so that they are not dependent upon the foundations for correct alignment.

The principal features of the construction lie in the constant-level lubrication system, the constant-speed unloader for the belt-driven machine, and the centrifugal unloader for controlling the starting and stopping. The base of the compressor forms an oil reservoir. Above this reservoir and directly underneath the connecting rod is a constant-level pan to which a small pump forces oil from the reservoir. If the amount of oil in the reservoir, is kept between the high- and the low-level pet cocks that are provided, the system will continue to function and keep the oil at a constant level in the pan. A projecting stem on the connecting rod dips into the pan and distributes the oil to the bearings.

When the receiver pressure rises above that at which the unloader is set to operate, the constant-speed unloader automatically opens the inlet valve, so that no more air is delivered. When the receiver pressure has fallen to a predetermined amount, the unloader automatically releases the inlet valve and allows the compressor to again return to work.

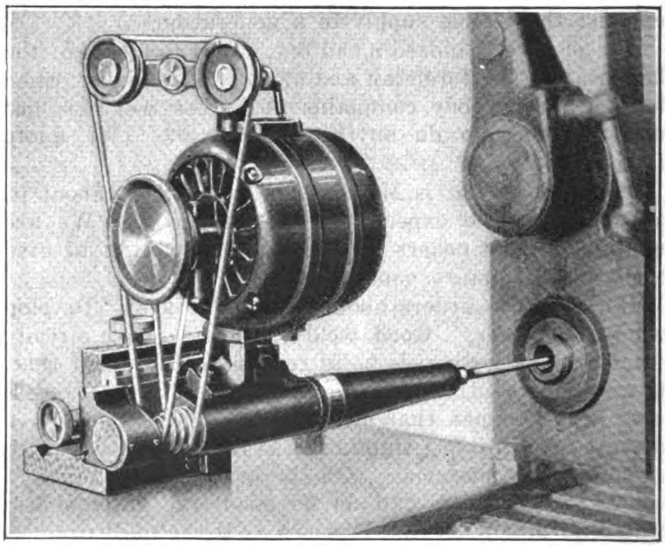
The centrifugal unloader permits the compressor to start under "no load," as is essential when automatic start-and-stop control is used, and it allows the driving motor to come up to full speed before the load is thrown on. This unloader operates by holding the inlet valve open until the motor has reached full speed.

The smallest size of the machine is built with either a ribbed cylinder for air cooling, as shown at the left of the illustration, for use where the service is intermittent, or with a water-jacketed cylinder of the reservoir type for constant service. All other sizes are built with the water jacket, as shown at the right. The reservoir pots are of large size and capacity.

"Precision" Extension Spindle and Housing for Thread Grinder

An attachment consisting of an extension housing and an extension spindle for all models of its multi-graduated thread grinder, such as described on page 160, Vol. 52 of *American Machinist*, has recently been placed on the market by the Precision & Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa. The device is applicable to deep internal grinding and can grind to a depth of 12 in. on holes 2 in. or greater in diameter, and to a depth of 6 in. on holes ½ in. in diameter.

The device has a number of uses, and can be mounted on machines of different types. It is shown in the illustration herewith mounted for grinding the tapered bore of a milling machine spindle. Such an operation can be quickly performed, so as to give perfect concentricity to the bore after it has become scored or worn. The tapers of lathe spindles can be ground in the same manner, with the grinder mounted on the



EXTENSION SPINDLE ON "PRECISION" GRINDER

toolpost. Besides grinding deep holes in jigs, fixtures and other work, holes that are difficult of access because of projecting obstructions can be reached.

The extension housing is screwed directly on the threads at the front of the spindle cap of the grinder. The extension spindle couples on the end of the regular spindle by means of a tapered joint. It is supported by double radial and end-thrust ball bearings at the extreme outer end of the housing. The mounting is stated to give rigidity at the wheel end of the spindle.

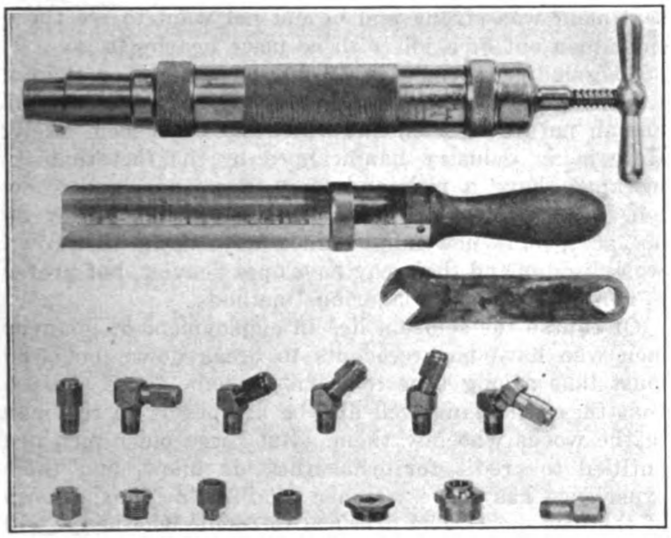
"Dot" High-Pressure Hand-Operated Bearing Lubricator

A device for forcing oil or grease into bearings has recently been placed on the market under the name of the "Dot" lubricator by the Carr Fastener Co., Boston 39, Mass. The lubricator, which is hand operated, is adapted to use on all sorts of machinery where shafts or bearing surfaces require lubrication, such as cranes, stokers, conveying machinery, machine tools and automobiles.

Nipples are applied to the bearing boxes in the position where the oil hole or the oil cup is normally placed. Each nipple is provided with a spring loaded ball in the top that automatically closes the opening except when pressure is applied on it. Thus the hole is normally closed to prevent both the escape of oil from the bearings and the entrance of dirt. The nipples can be furnished to face at all angles, so that they can be easily reached by the lubricator itself. At the bottom of the accompanying illustration are shown a number of styles of nipples. A small dust cap is placed over each nipple, but can be readily removed for oiling. Extensions can be furnished in any length required. Reducing bushings and couplings, also shown, can be supplied in the desired sizes.

The lubricator proper consists of a pump which is fitted with a plunger for ejecting the oil from the forward end. This plunger is screw operated by turning the handle at the rear. The nozzle is an integral part of the device, so that no flexible coupling is necessary. The inside of the nozzle has a special triangular shape to fit the nipples. It is applied to the nipple, and the handle given a slight turn to the right, so that the nozzle locks to the nipple.

With further turning the valve in the lubricator



"DOT" LUBRICATOR AND FITTINGS

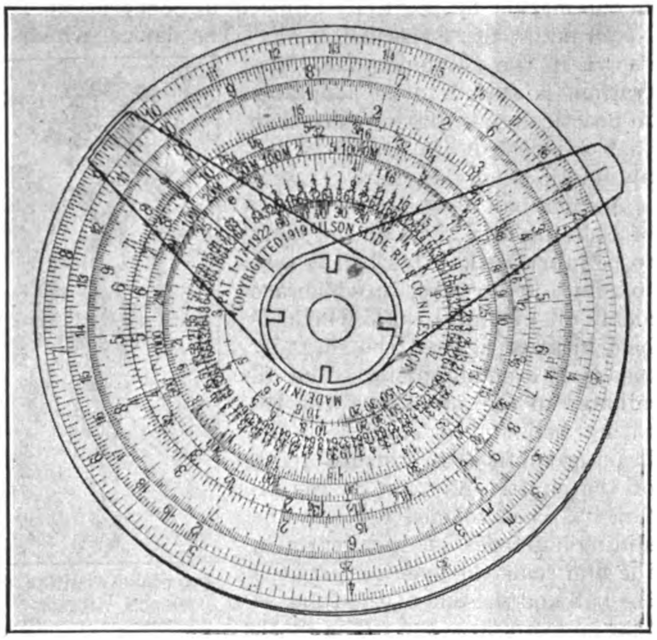
opens and the oil or grease is forced under high pressure into the nipple and to the bearing surfaces. A quarter turn of the handle to the left releases the nozzle from the nipple. No further turning back of the handle is necessary to prevent the escape of lubricant from the lubricator, as the valve automatically shuts off the passage.

Since such a high pressure can be obtained by the use of the device, either oil or grease may be forced into the bearings. If desired, kerosene may be employed before putting in the oil, thus washing off the surfaces. For use with grease, the filler shown in the illustration is furnished. The principal feature in the operation of the device is the fact that it can be used with one hand only, so that places difficult of access can be reached. The operator can thus lubricate bearings very rapidly.

Gilson "Midget" Circular Slide Rule

A circular calculator has just been placed on the market by the Gilson Slide Rule Co., Niles, Mich., under the name of the "Midget" slide rule. This instrument has all of the scales of the regular slide rule and several additional features which make it especially useful in the shop and drafting room.

There are nine engine-divided scales on the front side of the instrument and two celluloid indicators with hair lines for close reading. The long indicator always gives the answer to the problem that is being solved.



GILSON "MIDGET" CIRCULAR SLIDE RULE

On the back side are scales for giving sines, tangents, cosines and cotangents of all angles from 0 to 360 deg., and the decimal equivalents of fractions to six places.

The binary scale is divided into 64ths, 32nds, 16ths, etc., so that fractions and mixed numbers can be multiplied and divided without changing them to decimals. There is a scale divided into equal parts for reading to 0.001 in., concentric with a scale divided into 64ths, so that fractions and decimals may be added and subtracted and the result can be read as a decimal or to the nearest 64th.

Concentric with these two scales are the thread and drill size scales. The sizes of all drills from 60 to 1 and from A to Z are given in thousandths and to the nearest 64th of an inch. The thread scale gives the size of drill to use with any size tap having any V or U.S.S. thread from 3 to 50 per in. The size of the drill may be read as a fraction, a decimal, or a numbered or lettered drill.

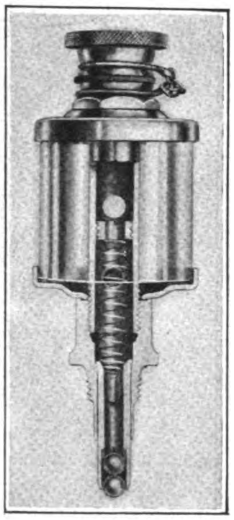
As the rule is 4 in. in diameter, the outer or C scale is about 12 in. long. This scale is for the ordinary operations of multiplication and division. The A scale gives square roots and the corresponding powers. There is a log-log scale which is a spiral and is graduated between 1.15 and 1,000,000. This scale gives every

possible root and power of any quantity. It also gives the natural logarithms (base e) of all numbers between 1.15 and 1,000,000. Another scale gives the common logarithm (base 10) of all numbers. There is a graduation at 0.3937 in. marked "c" which is equal to 1 cm., and other useful graduations as 3.1416 and 0.7854 are indicated.

With the exceptions of the log-log, thread and drill scales, all of the graduations are on circles. It is therefore impossible for the answer of a problem to fall off the end of the scale, as often happens when a straight slide rule is used. The graduations are on white celluloid mounted on aluminum, and are waterproof.

Auto-Vac Ball-Feed Bearing Lubricator

A lubricator for machine bearings designated as the "auto-vac" ball-feed lubricator has recently been placed on the market by the Kelly Lubricator Corporation, 107 N. Franklin St., Syracuse, N. Y. The device, which is shown in the accompanying illustration, is stated to be adaptable to practically all bearing speeds so that lubrication is positive and automatic at any speed.



AUTO-VAC BALL-FEED LUBRICATOR

A small ball fitted at the bottom of a sliding tube rests on the shaft to be lubricated. This ball is free to rotate in its tube, in which are small oil channels, and which is held in place against the shaft by means of a small spring. The oil adheres to the surface of the rotating ball and is carried to the bearing surfaces by the revolving of the shaft. As soon as the oil film has been formed between the sliding surfaces of the bearings, the film seals the opening between the ball and the end of the tube, so that no more oil is fed to the shaft. It is stated that more oil does not leave the cup until this film has become broken. Since oil is fed only when it is needed on the bearings and not when the machine is at rest, a considerable saving is stated to be possible. The positive lubrication is of value particularly on bearings using high speed, such as on blowers and grinders, as the shaft is always kept lubricated. After the lubricator has once been adjusted, no further adjustment or setting is necessary when starting or stopping the machine.

The oil cup has a large opening at the top for filling it. The glass body is held in place by a brass top and bottom fitted with gaskets. The base of the cup has standard pipe threads and the stems are made in various lengths to suit the thickness of bearing cap to which the lubricator is fitted. The lubricator is made in four sizes having capacities of ¼, ½, 1 and 2 ounces.

Grinding Off Stock

By Entropy

The other day I dropped into a shop where they make among other things some good sized axes. The axes are, of course, first forged and then ground to get their shape, then hardened, tempered and ground to sharpen them. In the room where they were doing the first grinding I looked at the wheels and the work and watched the men. It looked as though they were working unnecessarily hard and as though it was taking more power to do the job than it should, and that they might do the work faster, and do less work and use less power if they used a softer wheel. I asked the superintendent, who was going through with me, if they had ever tried using a softer wheel. He said that they had, that he thought the softer wheel was the right thing, but that their shop was "different" and that it did not pay.

Further inquiry brought out this state of affairs. The men are piece workers, they have many of them been in that kind of work for years, back to the time when such work was all done on natural grindtsones, and when it was considered that an emery wheel would ruin the work if used. They were used to bearing on very hard. When the soft wheels were tried the men bore on just as hard as ever, with the result that they overheated both work and wheel. They ran up their earnings very fast, but they had a great number of mishaps due to bursting wheels, which could only be laid to the overheating of the wheel. Consequently, the management went back to their standard grade, and the accidents ceased and everybody was satisfied, except the firm that did not make as much money and the workmen whose earnings went back to their old rates.

Difficulty of Training the Workers

The superintendent found it impossible to educate these older men to bear on somewhat less, and to be satisfied with something less than the maximum rate of pay which they might have made. He had thought of letting out all the old hands and training up a new crop of men to take their places who would not have any oldtime experience to unlearn, and who would be willing to learn the way the shop thought best, but sentiment was strong and he did not want to see these older men out of a job with no place nearby to go.

So grinding becomes a labor problem rather than a scientific one, unless it can be said that sizing up of human nature is scientific, which does not seem likely. Here is an industry handicapped by the fact that its workmen have a rich and long experience, and know how in their own minds to do a given job. They do not accept the new-fangled idea of making their own work lighter and their pay envelopes heavier, but prefer to continue their old laborious methods.

Of course the solution lies in employment of younger men who have no precedents to break down, but who must take a long time to learn to shape these axes so that they will hang well and be acceptable to the men in the woods who buy them. But these older men are entitled to credit for what they do know, and their experience has to be weighed against the inexperience of the new men. The firm has to decide whether it will uninterruptedly turn out axes acceptable to the men in the woods and let the cost run high, or whether they will cut down the cost by employing men who cannot get the correct shape every time and whose product is less expensive but also less saleable.

In this instance the cost of sales is considerable, for these axes cannot be sold direct from the shop to the consumer but must be distributed to every hardware store and every general country store on the continent and then to some more continents. Here the cost of selling something that did not just exactly suit a customer of whom the factory knew nothing outweighed a very substantial reduction in the cost of manufacture.

News Section

National Airplane Races Will Draw Big Crowd to Detroit

Widespread interest is being centered in the National Airplane Races which will be held at Selfridge Field, Mt. Clemens, Detroit, October 7, 12, 13 and 14. The races will be conducted by the Detroit Aviation Society, and are sanctioned by the Aero Club of America.

The official program of the races which has just been issued, schedules the following events:

Event 1. October 7, Detroit Aerial Water Derby, including the Curtiss Marine Flying Trophy. This will be a free-for-all race for flying boats and seaplanes. First prize, $1,200; second, $600; third, $200, and award of Curtiss Trophy to winner. Distance 160 miles.

Event 2. October 12, Detroit News Aerial Mail Trophy. This will be a race for large-capacity multi-motored airplanes. Cash prizes, the same as in Event 1, and award of trophy to the winner. Distance 240 miles.

Event 3. October 12, Aviation Country Club of Detroit Trophy. This will be a race for light commercial airplanes. Cash prizes, the same as in Event 1, and trophy to the winner. Distance 240 miles.

Event 4. October 13, Liberty Engine Builders' Trophy. This will be a race for observation type (2 passenger) airplanes. Cash prizes, the same as in Event 1, and trophy to the winner. Distance 240 miles.

Event 5. October 14, Pulitzer Trophy, free-for-all race for high-speed airplanes. This race promises extraordinary features because of the new types of high speed craft which are entered. Cash prizes, the same as in Event 1, and award of Pulitzer Trophy to the winner. Distance 160 miles.

Power Exposition Will Draw From All Industries

Engineers well known in industrial and public utility power generations make up the advisory committee which is guiding the National Exposition of Power and Mechanical Engineering. This exposition will open at the Grand Central Palace, New York City, on Dec. 7 at noon and will extend through to Dec. 13 (except the intervening Sunday). It will immediately follow the annual meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. Irving E. Moultrop of the Edison Electric Illuminating Co., Boston, heads the advisory committee, and his colleagues are: Dexter S. Kimball, president the American Society of Mechanical Engineers; Alexander G. Christie, chairman, power division, A. S. M. E.; Fred Felderman, national president, National Association of Stationary Engineers; Milan R. Bump, president, National Electric Light Association; N. A. Carle, vice president, Public Service Production Co. of New Jersey; E. B. Katte, chief engineer, Electric Traction, N.Y.C. R.R. Co.; Fred R. Low, Editor *Power;* David Moffat Myers, consulting engineer; Calvin W. Rice, secretary, A. S. M. E., and the managers, Charles F. Roth and Fred W. Payne.

The list of firms who have already reserved space shows that all apparatus and materials used in harnessing the energy released from fuels will be represented.

All members of the American Society of Mechanical Engineers who attend the meeting will receive the half fare return certificate which will enable them to attend the exposition.

Italy as a Market for American Machinery

It would doubtless pay American manufacturers to watch the Italian market, says a correspondent writing from Switzerland. While during the last few months German, English and Swiss sales agents are to be found in almost every large city seldom is an American salesman met in Italy. And yet there are many opportunities for American machinery manufacturers. American-made machines are in high favor in that country and a special opportunity is being offered by the extension of most of the Italian seaports.

The Italian Parliament has just passed a law according to which no less than 1,500 million lire will be appropriated for the extension and reconstruction of some of the foremost Italian ports. The harbor of Genoa will receive 144 million lire for this purpose, Venice 85 million lire, Bari the same amount, Savona and Cotrona receive 84 million lire each, Palermo on the island of Sicily, 66 million lire, Naples 50 million lire. Ostia, the port of Rome, is to receive 47 million lire, Messina and Spezia 40 million lire each and Catania, 36 million lire.

The rest of the amount will be spent for reconstruction and extension work on the ports of Leghorn, Oneglia, Ancona, Riposto, Corsini, Ortona, Civita-Vecchia, and Rimini. Manufacturers of dredging and excavating machinery, pumps, etc., should pay special attention to the possibilities offered in Italy during the next few years.

Cost Accountants Elect Officers

The National Association of Cost Accountants in convention last week in Atlantic City elected J. P. Jordan, industrial engineer of New York, as president; C. M. Finney, of New York, first vice president; S. L. Whitestone, Schenectady, second vice president, and Harold Dudley Greeley, of New York, as treasurer. The secretary is named by the executive board.

C. R. Stevenson and W. S. Gee, of New York, were elected directors for three years and William M. Lybrand and H. B. Fernald, New York, for one year.

American Bankers Association Convention

Plans for one of the greatest financial congresses in the history of the nation are contemplated in the arrangements for this year's convention in New York City of the American Bankers Association, falling as it does at a particularly formative time in the new era of world business, it is declared in a preliminary announcement of the program issued by the association during the past week.

The convention, which is the forty-eighth annual meeting of the association, will be held at the Hotel Commodore, New York City, Oct. 3, 4 and 5.

The Right Honorable Reginald McKenna, formerly Chancellor of the British Exchequer and now chairman of the London Joint City and Midland Bank, will discuss 'Reparations and International Debts.' Thomas W. Lamont of J. P. Morgan & Co. will treat world finance from the American viewpoint. Henry J. Allen, the fearless, aggressive Governor of Kansas, will discuss the responsibility of the government for industrial justice and the relation of the Federal Reserve System to American business.

Gear Manufacturers to Hold Semi-Annual Meeting

The American Gear Manufacturers Association will hold its semi-annual meeting at the Drake Hotel, Chicago, Ill., October 9, 10 and 11. An impressive program has been outlined which in addition to reports of committees and routine business, will include a number of interesting addresses. Among these will be "The Evolution of the Gear" by George L. Markland, Jr., president of the Philadelphia Gear Works; "Apprenticeship" by P. C. Molter, superintendent, Department of Industrial Education, The National Metal Trades Association; "What the Association Needs from Committee Men, After Nearly Six Years Secretarial Observation" by Frank D. Hamlin, vice president, The Earl Gear and Machine Co.; "Why Buy a Pig in a Poke" by L. G. Hewins, sales manager, The Von Dorn & Dutton Co.; "Sandardization of Gear Sounds" by Prof. Daniel L. Rich, University of Michigan; "Engineering Research" by Prof. A. E. White, Department of Engineering Research, University of Michigan, and others.

The regular informal banquet will be held on Tuesday October 10. John B. Foote, president of Foote Bros., Gear and Machine Co., Chicago, who is one of the older members of the association will be toastmaster. The speakers on this occasion will be the Hon. Marcus Kavanagh, Judge of the Superior Court of Cook County, Illinois who has announced as his subject "Business Man and Law Enforcements"; and General John V. Clinnin who will speak on "Effect of the Late War of the World."

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

At my request checks for comparatively large amounts on 14 of the more important New York banks and trust companies were cashed last week. "20's" and "50's" were asked for but the currency in which payment was desired was not otherwise specified. Against these checks the payees received an average of about 60 per cent in gold certificates or "yellow backs."

These "yellow backs" as is generally known, are receipts certifying that the equivalent in gold has been deposited with the United States Treasury and is payable to the bearer on demand. I arranged to have the checks cashed to ascertain whether there was any basis for the report that the banks were making an effort to get gold into circulation. The result seems to indicate that such an effort is being made.

As to its purpose opinions differ, but it is plain that if a substantial portion of the gold now impounded in the Federal Reserve Banks is put into circulation a reduction in the reserves, the reserve ratio and the lending power of the banks will follow. As the gold held by the Federal Reserve Banks gained $15,000,000 last week and the reserve ratio stands at 78.4 per cent the distribution of a few millions of gold does not make much difference just now, but the fact that the gold which was so jealously accumulated two years ago is now being paid out unasked for seems to suggest that the banks realize that its retention where it can be seen might incite inflation and that they are doing what they can in a quiet way to get it out of sight.

Incidentally it may be observed that if we ceased to import gold and the banks succeeded in forcing any considerable amount of their holdings into circulation the resulting reduction in reserves would be reflected in higher interest rates and a decline in the price of bonds and those dividend paying securities that fluctuate in inverse relation to the money market.

Coming events sometimes cast their shadows before and it may be that the decline in Liberty Bonds and other high class obligations is due to the selling of some long headed financiers who foresee "tighter money" sooner than is generally expected. Meantime all the Liberty 4¼ per cent issues are again below par and the enormous transactions recorded during the week indicate that some very large holdings have been disposed of.

These considerations and the expectation that Secretary Mellon will shortly undertake some very important refunding operations that will temporarily tie up much capital lead me to feel that for the present at least any further advance in the security market is unlikely.

Special stocks may be put up for special reasons but commercial loans are gradually increasing and bankers probably foresee a further demand for money from merchants that would make it difficult to finance a concurrent boom in stocks.

As to our domestic trade in merchandise all the indicia continue favorable. Some hesitancy has, however, been induced by the apparent truculence of Kemal and the fear that he may compel Great Britain to resort to force or attract the support of the Russian Soviet army. The news from Constantinople and Asia Minor may, in fact, be interpreted according to taste. No one really understands its import or can foresee the future. Most thoughtful Americans are disposed to be cautiously confident of peac although we are so isolated that the outcome will not make much difference to us in a material way except as it may affect Europe's ability to buy of us and our export trade.

> **Although confident of peace, thoughtful Americans are looking upon the situation in the Near East with caution. While our trade on this side of the Atlantic and with the Orient may not be greatly affected, an outbreak of hostilities would, without doubt, disturb seriously our commerce with Europe.**

But when we consider our own tariff bill and the impoverishment of Europe it becomes a question of whether we can expect much transatlantic export trade in any event. Three of the largest American life insurance companies have announced their withdrawal from all Europe except England and our financial and commercial relationships with the territory thus abandoned arc likely to become more and more tenuous pending the re-establishment of fiscal and political order.

This is why I doubt whether business in the United States would be much shocked by an actual outbreak of hostilities abroad. From the standpoint of the humanitarian such a contingency is horrible to contemplate but it would not much effect our trade on this side the Atlantic or with China and Japan.

The decline in sterling exchange, which is selling at 4.36 as I write, is, however, about the only item in the week's financial news that can be interpreted as distinctly unfavorable. Marks are a shade lower but what else could be expected with an increase of 19 billions in the quantity outstanding, which is now about 290 billions.

Considered in detail the commodity markets have acted normally. Wheat advanced when the dogs of war came nearer and declined as they retired. But upon the whole the wheat market seems to be intrinsically stronger. Cotton reversed the action of wheat as it always does when war threatens, but with the South selling about 50,000 bales a day at an average of $100 per bale and thereby strengthening its cash position at the rate of 30 million dollars a week an advance was hardly to have been expected. After a few weeks of this the cotton planters will be able to hold the rest of the crop comfortably and this is what they threaten. Meantime the American spinners seem wisely disposed to buy freely as the market approaches 20 cents, below which it is unlikely to go at present.

Wool is firm both here and abroad. So is silk, burlaps, jute and paper. The demand for all grades of the latter article is said to be in excess of the supply. Rubber is sharply higher in the London market and sugar is slowly creeping up as the strength of the position becomes better understood. A further advance on both rubber and sugar seems to be clearly indicated. Hides, leather and the shoe trade comprise another group of which increased activity at better prices is reported. Glass, lath, flooring and most building material except brick are also higher. Steel continues firm with the railroads large buyers at higher prices. Copper is static at 14 cents although the demand is large.

The trade in woolen, silk and cotton textiles is good, but there is a scarcity of staple cotton goods and some of the New England manufacturers are demanding higher prices.

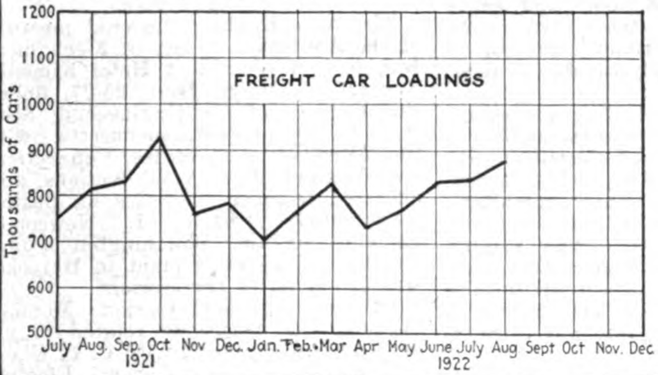
On the whole the feeling seems to grow more and more cheerful the farther one gets from the Stock Exchange and this cheerfulness of feeling was especially noticeable in Dayton, Detroit and Cleveland, to which cities I paid a hurried visit last week. Nearly everyone in the Middle West seems hopeful and Henry Ford's popularity has been greatly increased by the decline in bituminous coal which is justly or unjustly ascribed to his boldness in fighting the coal profiteers.

The fact is that coal for which $9 was asked three weeks ago can now be bought at $5. I don't know who is responsible for the drop but everybody except the coal dealer is now singing "Praise Ford from whom all blessings flow."

The railroads are doing an enormous business. There is now a shortage instead of a surplus of cars and loadings during the week ending Sept. 16 totalled 945,919 cars.

There is every prospect of an acute freight blockade later in the season but this is generally an incident of good times, and prohibitive rates for money is about the only thing that will check the expansion that appears to be in prospect.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association.



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base.

LOADINGS of revenue freight on American railroads during August averaged 887,000 cars a week. During the first half of the month weekly loadings remained nearly stationary as compared with the July period. The movement of coal and grain in the latter part of the month, advanced loadings sharply from 856,219 cars on August 19 to 890,838 cars on August 26. Since that time the weekly advance has continued rapidly, the week ending September 16 witnessing a total of 945,919 cars loaded.

Automobile production during August, with 246,941 passenger cars and 24,064 trucks, recovered some of the ground lost during July. The month of June holds the record with a total of 289,011 cars and trucks. During July, production dropped to 245,414 machines, a seasonal falling off which was not unexpected. In August, however, contrary to expectations the seasonal slump did not continue. Neither did the coal and railway strikes have the depressing effect looked for in many quarters. The advent of new models and a sharp fall buying movement resulting from a desire to take advantage of price reductions, stimulated an increase in production over July.

Share markets continued their upward advance during August, the average price of 50 stocks, 25 rails and 25 industrials, reaching 86.66 as compared with 81.25 for July. In the movement starting in the early part of July new high records were established in the last seven days of August. Strikes in the railroad, textile, coal and steel industry had practically no effect on prices, the public buying high grade seasoned rails and industrials with supreme confidence in the country's prosperity. Excellent crop prospects added stimulus to the buying activity during the month.

Comparative Prices of Shop Supplies

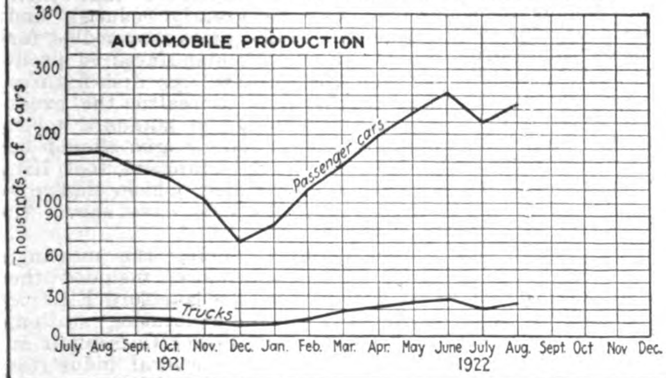
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0289	$0.0280	$0.0273
Cold finished shafting......	per lb........	0.0373	0.0360	0.0384
Brass rods.....	per lb........	0.1717	0.166	0.1350
Solder (½ and ½)	per lb........	0.228	0.221	0.202
Cotton waste..	per lb........	0.115	0.11	0.113
Washers, cast iron (½ in.)...	per 100 lb.	4.30	4.00	5.00
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal.......	0.575	0.575	....
Machine oil....	per gal.......	0.36	0.36	....
Belting, leather, medium......	off list........	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

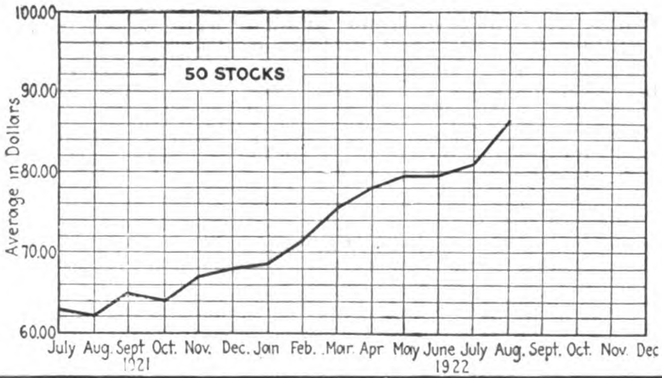
Bituminous coal prices, as indicated by *Coal Age* index, averaged 507 during August, the average spot price for the same period being $6.14. While the accompanying chart shows merely the monthly fluctuations, the highest point reached during the recent strike was on July 31, the index rising sharply to 556. August 7 witnessed a drop to 511. On August 14, due to a lack of available spot coal, the index again rose to 550. From this point there has been a continued downward movement, the index reaching 437 on August 31, resulting in an average for the month of 507. Despite the increase in supplies as the mines have opened, consumers have postponed buying, the weakened demand bringing prices down.

Reserve ratio of the Federal Reserve System remained practically unchanged during the week ending September 27, at 78.4 per cent. Foreign exchanges were downward with sterling at $4.39¼, the lowest in three months. French francs and Italian lire show but slight change as compared with the week previous. Bank of England's reserve declined slightly, from 19.61 per cent on September 21, the year's high point, to 19.40 per cent on September 28.

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Average for 1919, 138,138 cars; 26,364 trucks.



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week.



Machine Tool Exhibition Widely Attended

One of the most satisfactory and widely attended exhibitions of machine and small tools ever held in New England closed Saturday, September 23, after a three days' run. The exhibition, which was under the joint auspices of Yale University, the New Haven branch of A.S.M.E., and the New Haven Chamber of Commerce, was held in the Mason Laboratory of the Sheffield Scientific School, 9 Hillhouse Ave., New Haven, Conn.

The exhibitors numbered well over one hundred and included practically all of the better known New England firms identified with the machine tool trade. Exhibits ranged from small cutting tools, drills, taps, reamers, saws, etc. measuring tools and instruments of precision, to the larger and heavier classes of automatic and semi-automatic production machinery.

The growing importance of the elimination of friction in moving machinery was attested by the exhibits of the ball bearing manufacturers, all of whom in New England were represented. Manufacturers of abrasive wheels showed entertaining and instructive exhibits of the stages and processes that go to the making of a complete wheel from the raw materials. Steel manufacturers were represented with exhibits showing fractures of various grades of steel, the steps taken in its manufacture, and records of its performances.

Automatic Machinery Progress

Small precision machine tools for use in watch, tool and gage work, in the production of which class of machinery New England has always taken a premier position, were well in evidence. Some of this machinery was in operation on actual production work and attracted a good deal of attention.

Perhaps the most noticeable tendency in machine design disclosed by the exhibition is the trend toward automatic production in operations that have hitherto been looked upon as necessarily manual. A few years ago machine tool builders were satisfied to furnish a machine or tool that would do its allotted work quickly and well under the guidance of a skilled operator. Today in many cases the machine is expected to be left to itself after being supplied with work, and to go on repeating its cycle of operations as long as any material remains.

Notable among this class of machinery was the engine lathe, which would take a bar of stock from a magazine, put it on centers, turn and face various shoulders, discharge the finished product and pick up another piece; repeating this cycle as long as there was any material in the magazine. Automatic die-sinking machines, once furnished with a master die and material to work upon, would go on duplicating the master die as long as might be desired with very little attention from the operator.

Drilling and grinding machines also have become infected with the automatic bug and even the humble lathe chuck, that once we were content to operate with wrench or key, will now obligingly open and close itself at the bidding of the operator without the necessity for stopping the lathe.

The advance in the art of taking precise measurements and making minute comparisons was well attested by the exhibitors of tools and gages for this purpose. To these instruments the one-hundred-thousandth part of an inch is a reality amply capable of demonstration.

Portable tools for drilling and grinding, stimulated by the remarkable development of the small electric motor, have made rapid strides and it is now possible to do many minor operations of machining that heretofore required the service of a permanently located machine, upon smaller tools that may be transported to and set up on the job, needing only to be attached to a convenient lamp socket to put them in operation.

Many Important Papers Read

The speaking program of the exhibition was opened upon Thursday evening by Kenneth F. Lees, Chairman of the Committee for the New Haven branch A.S.M.E., who introduced L. P. Breckenridge, professor of mechanical engineering at Yale, as chairman of the meeting. Greetings from the New Haven Chamber of Commerce were extended by Henry B. Sargent of that organization. Charles H. Warren, dean of Sheffield Scientific School, earnestly advocated closer co-operation between the colleges and the machine tool industry. James T. Hartness, Governor of Vermont and an ex-president of the A.S.M.E., delivered an address upon the "Influence of the Machine Tool in America."

On Friday evening, M. D. Liming, manager of the Boston Chamber of Commerce, spoke upon the "Outlook for Industry in New England" and Earle Buckingham, engineer at Pratt & Whitney Co., gave a talk upon "Precision, Standardization and Production," followed by an address upon the subject of "Standardization Activity in Germany" by Oscar Wikander, Consulting Engineer with the S.K.F. industries.

Saturday evening's programme included a talk by William Calkins, Metallurgist for the Detroit Twist Drill Co., upon the "Design, Manufacture and Performance of Twist Drills," the talk being illustrated with the stereopticon; "Application of Graphic Control to Machine Manufacture" by Gardner T. Swarts, Jr. of the Educational Exhibit Co.; and "Analysis of Income in the United States" by Oswald W. Knauth, Secretary National Bureau of Economic Research.

On Friday and Saturday afternoons the moving picture projectoscope belonging to the Laboratory was pressed into service and a number of interesting films dealing with processes of manufacture were shown. Among them were: "The Hydroil Grinder" by the Greenfield Tap & Die Corp., "The Spirit of Progress" by the National-Acme Co. of Windsor. Vt.; "The Manufacture of Small Tools" by the L. S. Starrett Co.; "Where and How Fords Are Made" by the Ford Motor Co.; "The Manufacture of Twist Drills" by the Cleveland Twist Drill Co.; and "The Machinery and Processes Used in the Manufacture of Carborundum" by the Carborundum Co. of Niagara Falls.

Though no record was kept of the attendance the throngs about the various booths attested the popularity of the exhibition and promise of a more extensive exhibit for next year.

New England A.S.M.E. Holds Regional Meeting

The New England regional meeting of the American Society of Mechanical Engineers was held at Hotel Kimball, Springfield, Mass., Sept. 25-27, under the auspices of the Engineering Society of Western Massachusetts, with the Worcester, Providence, Connecticut and Eastern New York sections and affiliated technical societies of Boston represented. Charles L. Newcomb, manager of the Worthington Pump and Machinery Co.'s plant in Holyoke, was chairman of the sessions.

At the opening session Monday morning the discussion related to industrial power plants, with C. C. Chesney, manager of the General Electric Co.'s Pittsfield (Mass.) plant, acting as chairman. R. A. Packard, superintendent of power and shop for the Ludlow Manufacturing Associates, led the forum with a paper on "Multiple Source of Power for Reliable Industrial Plant Operation."

Tuesday morning there were simultaneous sessions on textiles and tools, with Dr. H. C. Emerson and A. L. Bausman as the respective chairmen. In the textile division a paper was read by Wendell S. Brown, of F. P. Sheldon & Son, Providence, on "Preservation of Decaying Wood Roofs," telling how the destructive effects of "damp rot" due to high or great humidity in mills and shops could be combated.

Machine Tool Standardization

In the tool section a paper on "Suggestions as to the Standardization of Machine Tools," by Fred H. Colvin and K. H. Condit, editors of the *American Machinist*, was read. The subject was treated from the viewpoint of the user, as related to work-holding and tool-holding devices. He further suggested as a probability that the machine tool builders may find standardization desirable in a greater degree, thus tending to simplify manufacture and reduce the number of tools, gauges and bearings carried in stock. While the engineer may recommend standardization, the decision of the manufacturer alone can assure its extention. Here the question resolves itself into a "selling" problem, for which the average engineer is not temperamentally suited, but for which machinery already exists in the American Engineering Standards Committee.

This was followed by a paper on "Standardization of Small Tools," by C. J. Oxford, chief engineer of the National Twist Drill and Tool Co., Detroit. He said that while the total elimination of special tools is impracticable, there is no doubt that their number can be greatly reduced, and engineers and designers responsible for the design of both manufactured product and the various jigs and fixtures must be brought to realize the great economic advantage of standard tools. Obsolete styles and designs should be stricken from the standard tool list, and tools substituted which that experience and research have shown to be more efficient.

Plants visited during the meeting, besides the Strathmore, included the Fisk Rubber Co., the Hartford Electric Light Co.'s steam generating station, the Turners Falls Power Co.'s plant at Montague City, and several industries of Holyoke.

What the 67th Congress Accomplished

Despite lengthy debates over leading measures and the political atmosphere which was spread over many of the proceedings, the second session of the Sixty-seventh Congress, which came to an end Sept. 22 after having extended from Dec. 5, 1921, enacted considerable important legislation.

The Democratic minority, although overwhelmingly outnumbered, was active and well led throughout the session in both branches of Congress. The Republican majority proved unwieldy because of its size, this fact tending to slow the transaction of business rather than to expedite it. The session developed and solidified the "bloc" system—that is, the agricultural bloc in both Senate and House, the farm tariff bloc in the Senate and the Henry Ford-Muscle Shoals bloc in the House, each bi-partisan in character, with indications that a ship subsidy bloc of similar nature probably will make its appearance at the next session.

During the session, appropriation bills providing for the expenditure of upward of $2,250,000,000 were passed, estimates having been reduced more than $300,000,000. There were 251 laws enacted at the session.

On the negative side, the session failed to take final action on the administration ship subsidy bill, the $5,000,000 Liberian loan, a corrupt practices act, the anti-lynching bill, extension of land reclamation, disposition of the Muscle Shoals project and a large number of measures less before the public eye.

Tariff the Chief Business

Enactment of the Fordney-McCumber tariff bill, the first permanent Republican protective tariff written on the statute books since the Payne-Aldrich bill of 1909, was the outstanding accomplishment of the session which affects business interests directly.

Excepting in isolated instances, the new tariff rates are higher than those of the Underwood-Simmons Democratic tariff law of 1913, but with the exception of the duty on raw wool and the rates of the agricultural schedule, the new tariff is lower than the Payne-Aldrich bill. The new tariff act marks a distinct advance in such legislation in its flexible tariff section, by which rates may be increased or decreased by Presidential proclamation upon proper showing, and by the section through which the authority of the Tariff Commission is broadened greatly with a view toward having a more scientific basis of framing future import duties. Among other important acts of the last session of Congress were:

Approval of seven treaties resulting from the Conference on Limitation of Armament, and legislation to scrap certain naval vessels in accordance with these treaties.

Reduction of personnel of the army and navy, with consequent reductions in appropriations.

Provision for the appointment of 24 additional judges for Federal district courts, and one additional circuit court judge.

Extension of the 3-per cent immigration law for two years.

Extension of the War Finance Corporation and enlargement of the revolving fund of the Farm Land Bank, together with provision for appointment of a "dirt farmer" on the Federal Reserve Board, for the agricultural interests.

Appropriation of $17,000,000 for additional hospitals for veterans of the world war.

Provision for organization of irrigation districts.

Passed the China trade act, the forerunner of other legislation to bring American corporations operating abroad on an equal basis with foreign competitors regarding taxation and protection.

Monthly payment of civil war pensions.

Appropriation of $7,500,000 to continue work on Wilson dam at Muscle Shoals.

Creation of the allied debt refunding commission.

Passage of the grain futures bill to overcome objections pointed out by the Supreme Court.

Congress also passed the bonus bill for veterans of the world war, but this was vetoed by the President because it made no provision for raising revenue to meet the obligations it created, and the veto was sustained by the Senate.

Business Items

The General Motors Corporation directors at their meeting held in New York last week declared the regular quarterly dividends as follows: Six per cent preferred, $1.50 a share; 6 per cent debenture, $1.50 a share; 7 per cent debenture, $1.75 a share. These dividends are all payable November 1, 1922, to stockholders of record at the close of business October 9, 1922.

The Davis Boring Tool Co., St. Louis, Mo., manufacturer of boring tools and expansion reamers, has just purchased a factory site fronting on Forest Park Boulevard on the corner of Spring Ave., and preliminary work has been started for the erection of a modern three-story factory.

The International Combustion Engineering Corporation has acquired the entire capital stock of the Green Engineering Co., East Chicago, Ind. The works of the Green Engineering Co. are located about fifteen miles from Chicago and the company is engaged in the manufacture of chain grate stokers, auxiliary boiler room equipment, special furnace arches and general foundry work.

The Armstrong Steel Co. plant will be constructed in Houston, Tex., at a cost of $2,000,000 and will employ several thousand men. Headquarters of the plant, now located in Fort Worth, will be moved to Houston after the plant is completed. The new plant will have a capacity of 60,000 tons annually, turning out manufactured steel products from a combination of pig iron and scrap iron by an open hearth process. The capacity of the company's plant in Fort Worth is 40,000 tons annually.

The Milwaukee Air Power Pump Co., Milwaukee, Wis., manufacturer of the Milwaukee air power water system, is building a new factory on Keefe Avenue, near Humboldt Boulevard, which is to be completed by the first of the year. John R. Ball is president and H. S. Rogers is vice-president and engineer in charge.

The Westinghouse Electric and Manufacturing Co., announces the establishment of a central station division in its Boston office, with C. M. Bates as manager and F. L. Nason as assistant manager. A merchandising division also has been established in the office with Mr. Nason as acting manager. J. P. Alexander has been appointed manager of the new transportation division in the same office.

The Chicago, Indianapolis & Louisville Railroad Co., according to an announcement made recently by officials in Indianapolis, has let contracts for eight new locomotives to be built by the American Locomotive Co. Five of the new engines are for freight and three for passenger service. It also was announced that orders have been placed with the Haskell-Barker Corporation at Michigan City for 150 new coal cars. Five new passenger coaches also have been ordered.

The Baldwin Locomotive Works, according to reports last week, had unfilled orders on its books aggregating about $37,000,000 in value and that the plants were now employing about 11,000 men and operating at approximately 60 per cent of capacity.

The Racine Metal Stamping Co., of Racine, Wis., Albert O. Falkenrath, president, announces a change in its corporate name to Racine Screw Works.

The Chicago Pneumatic Tool Co. earnings are running at a rate slightly above its dividend requirements and the volume of its business is about two and one-half times that of the early months of 1922, according to Charles M. Schwab, chairman of its board of directors.

The Ford Motor Co., according to reports, has been given a new production mark to aim at next year. Orders have been given to all general foremen to speed up production and install additional machinery with the view to making 6,000 cars a day by April 1, 1923.

The Packard Motor Car Co. according to reports is expected to show for the fiscal year ending August 31, net profits after charges and taxes, in excess of $1,000,000, or just about dividend requirements of $1,035,286 on $14,789,800 7 per cent preferred stock. In the preceding year the loss was $3,487,366 from operations and inventory depreciation, and after dividend payments of $1,346,410, there was a deficit of $4,833,776.

The Florida East Coast Railway, for the year ended Dec. 31, 1921, reports gross earnings of $13,579,109, a decrease of $122,082 from the previous year. Surplus earnings after all charges and taxes totaled $766,705, a decrease of $1,444,291 compared with 1920.

The Midwestern Tool Co. has been organized with Carl O. Swenson as president and Samuel R. Swenson as secretary, treasurer and general manager, and will be located at 5215 Ravenswood Ave., Chicago, Ill. The company has taken over the assets of the Ajax Tool Co. and will engage in the manufacture of hobs, milling cutters, tools, jigs and fixtures, and will also manufacture oversizes pistons for

the automotive trade. Samuel R. Swenson is well known to the trade through his former connections with the Goddard Tool Co., the Illinois Tool Co., and the Barber-Colman Co.

The American Machine and Foundry Co. stockholders have been called into a special meeting to be held on October 17 to vote upon a proposed increase in the company's capital stock from $2,000,000 to $10,000,000.

The Wiley-Hughes Supply Co., Trenton, N. J., has been incorporated in that city with a capitalization of $125,000 to deal in engineers' supplies. Leroy Wiley, Fred W. Hughes and Joseph Ashton, Jr., all of Trenton, are the incorporators.

The Westinghouse Electric and Manufacturing Co. makes the announcement that in its San Francisco office, the power division is changed to the central station division and W. P. L'Hommedieu has been appointed manager. Mr. L'Hommedieu will also be responsible for the sale of supply apparatus in the San Francisco district. The railway division has been changed to the transportation division and E. A. Palmer has been appointed manager. The establishment of a merchandising division, with H. L. Garbutt as manager is also announced.

The Republic Iron and Steel Co. is running its plants at about 80 per cent of capacity and the company, it is said, is booked practically full until the end of the year.

The Auburn Automobile Co., has declared the regular quarterly dividend of 1¾ per cent on its preferred and 1 per cent on its common stock, payable Oct. 1.

The Bethlehem Export Corporation, which has been incorporated in Delaware with a capitalization of $1,000,000, is the export subsidiary of the Bethlehem Steel Corporation. The action of the Bethlehem Steel Corporation in organizing an exporting subsidiary follows the decision to liquidate the Consolidated Steel Corporation, which has been handling the foreign business of 11 steel companies in this country.

The Ford Motor Co. is reported to have purchased recently a tract of fifteen acres in the eastern section of Toronto, Can., whereon it will erect an assembly plant to have approximately 150,000 square feet of floor space.

The Union Pacific Railroad system for August reports gross railway operating revenues of $17,627,803, against $20,041,541 in the same month last year. Of the $2,413,738 decrease in gross, $1,799,841 was due to smaller revenues from freight and $362,436 to smaller passenger revenue. Operating expenses aggregated $13,127,553, against $13,663,803 last year.

The Nash Motors Co. has declared a quarterly dividend of $1.75 on its preferred stock, payable Nov. 1.

The Rockwood Manufacturing Company, of Indianapolis, is to remodel its foundry into a machine shop and will build a one story extension to the present building, according to George O. Rockwood, president. The contract has been let and work is expected to begin shortly. The building, when added to and remodeled will be of brick and heavy mill construction, with wood block floors, steel sash, a gravel roof and a traveling crane.

The Hudson Motor Car Co., will pay its regular quarterly dividend of 50 cents per share on the capital stock on Oct. 5.

The Westinghouse Electric and Manufacturing Co. announces the following appointments in its St. Louis office: S. W. Perry as chief clerk; W. F. Barnes as manager of the industrial division; J. S. Warren as manager of the central station division and G. F. Leake as manager of the merchandising division.

The Springfield Commercial Body Co., Inc., has been formed in Springfield, Mass., with a capitalization of $200,000. Charles B. Ring is president and L. Philip Smith is treasurer of the new company which will engage in the manufacture of automobile bodies.

The Hermann Tire Building Machine Co., Columbus, Ohio, has been sold to W. H. Hermann, as has also the plant of the A. R. McDonald Co., St. Marys, Ohio. Machinery for making tools used in the production of casings and tubes will be installed in the latter plant.

The Willys-Overland Co. and subsidiaries for six months ended June 30, 1922, reports a net loss of $163,305 after depreciation and interest charges. After charging out $35,000 for contingencies, $250,000 for inventory losses and $570,909 for discount and expense of gold note issue deficit was $1,019,214 from which $26,750, which was deducted as dividend stock of employes and others returned to company, leaving net deficit for the period $992,464.

The Velie Motors Corporation has declared the regular quarterly dividend of 1¾ per cent on its first preferred stock, payable Oct. 2.

The Thomaston Knife Co., Thomaston, Conn., recently incorporated under the laws of Connecticut with a capital stock of $60,000, to engage in the manufacture of knives, cutlery, etc., organized the past week by the election of the following officers: president, Henry S. Hitchcock; secretary and treasurer, James D. Wedgewood, both of Woodbury, Conn.

The Holbrook Co., Hudson, N. Y., manufacturer of automobile bodies, plans the construction of additional plant capacity at a cost of approximately $100,000.

The American La France Fire Engine Co.. Inc., has declared the regular quarterly dividend of 2½ per cent on its common stock, payable Nov. 15.

The Youngstown Sheet and Tube Co., dividend, payable October 1, was increased to 75 cents a share at the meeting of the board of directors held recently at Youngstown, Ohio. The previous quarterly payment was 50 cents the share. The regular quarterly preferred dividend of $1.75 a share, also payable October 1, was likewise declared. The dividends in each instance are payable to stock of record September 20. The increase in the common rate is the first since the improvement in the steel industry. It is just one-half of the quarterly rate first paid on the common after the original shares of preferred of $100 par value were each split into four shares of no par value in 1920. The increase of 25 cents a share will add $200,000 to that company's quarterly disbursement on October 1.

The Asa S. Cook Co., Hartford, Conn., manufacturer of wood screw and bolt machinery, has moved its Cleveland office to 344 Engineers' Building, that city. Ernest W. Duston is the sales engineer in charge.

The Hupp Motor Co. will pay its regular quarterly dividend of $1.75 on the preferred stock on Oct. 1.

The Brown Instrument Co., announces the opening on Sept. 1, of its New England Branch 185 Devonshire Street, Boston, Mass., with George Goodman in charge.

The Ford Automobile Co. is reported to have bought a large tract of land on the outskirts of Antwerp, where an assembling plant will be erected. The plant will be ready for operation early next year. The factory force will be made up chiefly of Americans. Automobile parts will be sent from Detroit to Brussels and the cars assembled here.

The Southern Pacific Co. reports for August a decrease of $756,215 in net railway operating income, after expenses, rents, etc., as compared with the same month a year ago, thereby reducing that figure to $4,566,641. Operating revenues totaled $23,160,148, a decrease of $1,052,764. The drop in earnings is largely due to the result of the second month of the railway shopmen's strike.

Personals

DR. FEDERICO GIOLITTI, Italian metallurgist, was the guest of honor at a luncheon at the Bankers' Club, 120 Broadway, New York City, last week, where he was met by members of the iron and steel committee of the American Institute of Mining and Metallurgical Engineers. Dr. Giolitti was managing director during the war of the great Ansaldo works at Genoa.

SAMUEL MACCUTCHEON, assistant secretary of the North & Judd Manufacturing Co., New Britain, Conn., manufacturer of hardware, tools, etc., has been elected treasurer of the concern, by the directors, at a meeting held recently.

P. G. MERROW, secretary and treasurer of the Merrow Machine Co., Hartford, Conn., recently sailed for an extended trip abroad on business in the interests of his company. Mr. Merrow expects to visit the company's connections in Great Britain and on the Continent.

W. C. LEITCH, formerly representative at St. Louis, Mo., of the general sales division of the Gilbert & Barker Manufacturing Co., Springfield, Mass., has recently been transferred to the general offices at Springfield. E. F. BLACKBURN, who has been representative of the company at Fort Worth, Tex., succeeds Mr. Leitch, at St. Louis.

FRANK L. ATWOOD, who has been vice-president of the Midwest Engine Co., Anderson, Ind., will become general manager of the Hill pump plant in the same city, October 1. The sales and mechanical departments of the Hill plant will be moved from Indianapolis to Anderson.

L. A. NYE of the Cleveland office of

the Norton Co., has been transferred to the Cincinnati office, taking the place of A. F. Mellon, who resigned recently.

C. H. WESTON of the drafting department of the Norton Co., Worcester, has assumed the duties of Robert H. Cannon, recently transferred to the Cleveland sales staff.

E. H. ANTHONY has been appointed manager of the Chicago office for the Union Twist Drill Co., to succeed E. P. Walker, who is now with the S. W. Card Tap Co.

FREDERICK M. HOLMES was, during the past week, elected president of the North & Judd Manufacturing Co., manufacturers of hardware, tools, etc., New Britain, Conn., succeeding the late HOWARD C. NOBLE. Mr. Holmes has held various capacities since joining the company in June, 1900.

ROBERT H. LIBKE, formerly a member of the E. L. Essley organization, has been appointed Chicago district manager for the Toledo Machine and Tool Co.

F. W. PRATT, formerly advertising manager for the Goodell-Pratt Co., Greenfield, Mass., has been appointed to the post of manager of production, retaining his former title of assistant to the president.

ROBERT H. CANNON, for some time past connected with the sales engineering department of the Norton Co., Worcester, Mass., has joined the sales staff of the Cleveland office of the company.

H. H. COLBUS, formerly sales representative of the Halcomb Steel Co., has become associated with the Down Tool Works, Inc., Fleetwood, Pa., manufacturer of high speed drills and tools, with headquarters in Philadelphia.

H. G. HOBBS has recently become associated with the Gilbert & Barker Manufacturing Co., Springfield, Mass., as the company's representative in southern Ohio, making his headquarters in Columbus. Mr. Hobbs was formerly located in Winnipeg and Toronto, Canada, for the company.

SIDNEY W. FARNSWORTH of Evanston, Ill., former aide to Commander McDowell, a member of the staff of Admiral Sims during the war and more recently associated with the Steel and Tube Co. of America, has been appointed by Postmaster General Work as chief engineer of the Post Office Department. The position is a new one created in order that a mechanical engineer may pass upon the labor-saving devices which the Post Office Department may require in order to secure expeditious handling of the mails.

Obituary

MARCELLUS L. BAILEY, treasurer of the Union Manufacturing Co., manufacturer of chucks, gray iron castings, etc., New Britain, Conn., died at his home in that city, Sept. 26, following a long illness. Mr. Bailey was born in New Britain Dec. 31, 1856. He has been with the Union Manufacturing Co. for forty-five years.

J. W. KINNEAR, president of the American Stainless Steel Co., Pittsburg, Pa., died at his home in that city on September 8.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Shoemaking machinery of all descriptions for making cloth shoes—Spain. Purchase desired. Quotations, f. o. b. New York. Reference No. 3643.

Rubber sheeting 8 by 4 feet and $\frac{1}{16}$ to 1 inch thick, proof canvas and tarpaulin, complete with eyelets, 24 by 18 feet; and tool spring and cast steel, flat, round, and octagon—India. Purchase desired. Quotations, c. i. f. Karachi. Terms, cash against documents. Reference No. 3666.

Soft steel or puddled iron wire of best quality, galvanized for telegraphs; cast-iron pipe for water, interior diameters 50 to 250 millimeters and 3 and 4 meters in length; concrete mild steel bars; beams, T's, double T's, U's, and angles; and plain and corrugated galvanized sheets, 0.3 to 1.2 millimeters thick—Greece. Agency and purchase desired. Quotations, c. i. f. Piraeus. Payment, confirmed letter of credit in New York or against documents. Correspondence, French. Reference No. 3669.

Vulcanizer molds, assorted sizes, from 30 by 3 inches to 35 by 5 inches—Scotland. Purchase is desired. Quotations, f. o. b. nearest port. Payment, cash. Reference No. 3670.

Electric plants, machinery, hardware, groceries, timber, plain and galvanized iron, paints, woolen goods, soft goods, boots and shoes, leatherware, motor cars, motor lorries, tractors, drills and tools, and any lines required by the Government or general merchants—South Africa. Reference No. 3673.

Iron piping for gas, from ½ to 4 inches in diameter; and steel piping for drilling and boilers, from 5 to 18 inches in diameter—Italy. Purchase and agency desired. Quotations, c. i. f. Genoa. Reference No. 3675.

Machinery for manufacturing glucose—Mexico. Purchase desired. Catalogs of such machinery and instructions as to the proper way of manufacturing are requested. Quotations, f. o. b. American port. Payment, cash. Reference No. 3679.

Outboard motors of 2½ and 5 horsepower—Egypt. Purchase and agency desired. Quotations, c. i. f. Port Said. Cash will be paid against documents for samples. Reference No. 3683.

Telephone equipment, electric generators, internal-combustion power plants, low-pressure water wheels, rotary pumps, electric lighting equipment, and lighting equipment—Egypt. Representation of manufacturers desired by importers. Reference No. 3709.

Pamphlets Received

The Western European Division and American Business. Department of Commerce bulletin describing that part of the department's organization which specializes in aiding American business in its foreign trade with Western Europe.

Our World Trade. Foreign Commerce Department of the U. S. Chamber of Commerce. This publication is a detailed analysis of American foreign trade covering the period from January to June, 1922, with statistical tables showing value and volume of exports and imports.

Latin America. Trade and Economic Review for 1921, No. 9, on the economic conditions in, and the state of the U. S. trade with Latin America. Published and distributed by the Department of Commerce, Washington, D. C.

Hongkong. Trade and Economic Review for 1921, No. 10, on the economic conditions in, and the state of the foreign trade of Hongkong. Published and distributed by the Department of Commerce, Washington, D. C.

How the Far Eastern Division Serves the Business Public. Bureau of Foreign and Domestic Commerce Publication, containing instructive information regarding that part of the Department's organization which specializes in furnishing aid on Far Eastern commerce matters.

Trade Catalogs

Chucks. The Skinner Chuck Co., New Britain, Conn.—An interesting little book, "Chucks and Their Uses," has just been published by the Skinner Chuck Co. In order to facilitate the use of this book and standardize courses of instruction on the proper use of chucks, a supplementary booklet has been issued, to be distributed together with "Chucks and Their Uses." The title of this supplement, "Questions and Answers," indicates the nature of the booklet, which includes a series of the most logical questions arising in the minds of people handling chucks and gives correct and helpful answers to these questions.

Steel Stools and Chairs. The Angle Steel Stool Co., Plainwell, Mich. A folder with illustrations describing a varied line of steel stools and chairs suitable for factory and office use. The company has also just published a supplementary catalog illustrating and describing, not only its chair and stool line, but its various types of steel trucks, merchandise conveyors and steel cans for oily and other waste substances.

Signalling and Alarm Instruments. The Brown Instrument Co., Philadelphia, Pa. This company has just issued a new publication, known as catalog No. 85, containing considerable technical data, illustrations and charts bearing on its automatic control signalling and alarm instruments, its pyrometers and other apparatus for temperature control.

Expansion Reamers. The Davis Boring Tool Co., St. Louis, Mo. An illustrated folder with line drawings and complete details regarding the Davis line of expansion reamers.

Forthcoming Meetings

American Welding Society, Fall Meeting, October 2 to 5, in Chicago, Ill. Secretary, Howard C. Forbes, 33 West 39th St., New York City.

American Society for Steel Treating. Exposition and convention at the General Motors Co. building, Detroit, Oct. 2 to 7. W. H. Eisenman, 4600 Prospect Ave., Cleveland, is secretary.

Second National Aero Congress and National Airplane Races., Detroit, Mich., October 7 to 14, 1922.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

National Association of Farm Equipment Manufacturers. Annual Convention, October 18 to 20, Congress Hotel, Chicago.

Society of Industrial Engineers. Oct. 18 to 20. McAlpin Hotel, New York. Secretary, George C. Dent, 327 South LaSalle St., Chicago.

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Demand for car materials strongest feature of the market. Standard rails advanced $3 per ton, Oct. 1. Steel plates, $2@$2.15 per 100 lb., f.o.b. Pittsburgh, for fair tonnages on ordinary business; $2.25@$2.50, however, quoted on small tonnages and for immediate deliveries. Demand for structurals light; $2@$2.15 quoted, with occasional small lots at $2.25. Shortage of steel bars. Few mills taking on new steel business except on indefinite delivery basis. Steel sheets up 15c.@20c. per 100 lb. at Cleveland warehouses. Hoop steel, shapes, plates, bars and bands up 10c. in New York.

Electrolytic copper, 14¾c. as against 14⅝c.; tin, 32¾c. advanced from 32⅝c. and lead, 6¾c.@6⅞c. as compared with 6⅝c. per lb., f.o.b. New York, last week. Chinese antimony advanced and fabricated brass products up ¼c.@½c. per lb. in New York and Cleveland warehouses. Zinc higher in East St. Louis. Fabricated copper prices, stable. Long terne plates (base) up 20c. per lb. in Cleveland. Connellsville coke $1 per ton higher, for prompt furnace and foundry.

Declines—Slightly softer pig-iron market due to increased production. Higher prices expected, however, owing to advance in coke.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$34.27
Northern Basic	32.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	36.64
Virginia No. 2	37.17
Basic	34.00
Grey Forge	33.00
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	35.00
Basic	32.50
Bessemer	33.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Cincinnati	8.0	6 0	5@5½
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4 0
Cleveland	8.0	5.25	4 5
Chicago	6.0	5.0	4 0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 50@2.75	4.19	3.70	4.00
No. 12	2.60@2.85	4.24	3.75	4.05
No. 14	2.70@2.90	4.29	3.80	4.10
No. 16	2.90@3.20	4.39	3.90	4 20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized				
Nos. 10 and 11.	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.15	5.30	4.80	....
Nos. 22 and 24.	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.10	5.55
No. 28	4.35@4.75	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
		BUTT WELD			
1 to 3	68	56½	¾ to 1½	39½	24½
		LAP WELD			
2	61	49½	2	34½	20½
2½ to 6	65	53½	2½ to 4	37½	24½
7 to 8	62	49½	4½ to 6	37½	24½
9 to 12	61	48½	7 to 12	35½	22½
		BUTT WELD, EXTRA STRONG, PLAIN ENDS			
1 to 1½	66	55½	¾ to 1½	39½	25½
2 to 3	67	56½			
		LAP WELD, EXTRA STRONG, PLAIN ENDS			
2	59	48½	2	35½	22½
2½ to 4	63	52½	2½ to 4	38½	26½
4½ to 6	62	51½	4½ to 6	37½	25½
7 to 8	58	45½	7 to 8	30½	18½
9 to 12	52	39½	9 to 12	25½	13½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.50	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.06	5.50
Cold finished shafting or screw	3.90	3.60	3.70
Cold finished flats, squares	4.40	4.10	4.20
Structural shapes (base)	3.14	2.91	2.92½
Soft steel bars (base)	3.04	2.81	2.82½
Soft steel bar shapes (base)	3.04	2.81	2.82½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	2.91	2.92½
Bar iron (2.60 at mill)	3.04	2.81	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
⅛	6.50		11@12
$\frac{3}{16}$ to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.75
Tin, 5-ton lots, New York	32.75
Lead (up to carlots), St. Louis.... 6.15; New York	6.75@6.87½
Zinc (up to carlots), St. Louis..6.86@6.90; New York	7.50

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	21.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.00	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.25	9.50	.....
Solder (½ and ½), (caselots)	25.00	23.50	20.00
Babbitt metal (fair grade)	25.00	42.25	36.00
Babbitt metal (commercial)	15.00	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32 00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.25	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.00	4.75
Lead, tea	4.25	4.00	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3 00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.075	.06	.10
Wiping cloths, 13½x20½, per lb.	.08	.096	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.91	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 12.75	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville....per net ton		12.00	
Coke, prompt foundry, Connellsville...per net ton	13.50@14.00		

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	60%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	50-10-5%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	4.50	3.25	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.50	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.50	$3.35
Cone heads, ditto (net)	5.10	3.60	3.45
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2 67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ariz., Superior—Magma Copper Co.—shaper, vertical drill, power hacksaw, pipe threading machine, bolt machine and wet and dry grinder.

Mass., Boston—A. T. Stearns, 53 Merrimac St. (sheet metal worker)—foot punch press, circular power shears and electric drill (used).

Mich., Detroit—Standard Gear Co., 2821 Brooklyn Ave.—additional gear cutting machines.

Mo., Kansas City—R. Connor, 1821 McGee St., (machine shop)—electric drill.

Mo., Kansas City—The Standard Steel Wks., 16th and Holmes Sts.—pipe bending machine.

N. J., Jersey City—W. W. Kellogg, 117 Westside Ave. (pipe-fittings)—shop equipment, including lathes, drill presses and planers for addition to plant.

N. Y., Bemus Point—J. B. White—machinery, tools and equipment for proposed garage and service station.

N. Y., Buffalo—W. D. McGuire, 1479 Hertel Ave.—machinery, tools and equipment for proposed garage and repair shop.

N. Y., Rochester—C. Cunningham, 52 Hamilton St.—machinery, tools and equipment for garage and repair shop.

O., Dayton—Dayton Power & Light Co., 4th and Jefferson Sts.—machine shop equipment for plant at Millers Ford.

Pa., Bradford—The Gun Shop, 18 Chambers St.—one small lathe, foot or motor driven.

Pa., Eau Claire—W. H. Burkett—machinery, tools and equipment for garage and repair shop, to replace that which was destroyed by fire.

Pa., New Castle—Fowler Radiator & Mfg. Co., (manufacturer of radiators, boilers, etc.), E. L. Brundage, Mgr.—machinery and equipment for proposed addition to factory.

Pa., Oil City—**E. M.** Bowen—machinery, tools and equipment for proposed automobile repair and service station.

Pa., Scranton—T. F. Leonard Estate, 505 Lackawanna Ave.—mechanical equipment, tools, etc., for proposed garage on Adams Ave.

Pa., West Fairview—Holmes Garage Co.—machinery, tools and equipment to replace that which was recently destroyed by fire.

Va., Richmond—Chesterfield Motor Co., 19 Petersburg Pike—automobile repair machinery, incl. drill press and lathe.

Va., Richmond—J. L. Cottrell, 4024 Williamsburg Ave., (automobile repairs)—shaper, drill press and lathe.

Va., Richmond—H. L. Grow, 1 Midlothian Pike, (automobile repairs)—expansion reamer.

Va., Richmond—Kersey Motor Co., 1800 Decature St.—automobile repair machinery, including lathe, press, etc.

Va., Richmond—L. M. Walton, 3827 8th St. (automobile repairs)—lathe, drill press and burning in machine.

Wis., Monroe—The United Telephone Co., R. M. Austin, Mgr.—automobile repair machinery for proposed garage.

Wis., Sheboygan Falls—Wisconsin Regrinding Co., A. P. Schneidewind, Pres.—machinery for cylinder and crank shaft grinding and mill repair work, for proposed machine shop at Rhinelander.

Wis., Wisconsin Rapids—R. A. Ebbe—automobile repair machinery.

Ont., London—Middlesex Motors, Ltd., 781 Dundas St., F. B. Isaacs, Mgr.—complete equipment for proposed automobile service station and repair shop.

Que., Montreal—Red Star Refineries Ltd., Canada Cement Bldg., M. Chatfield, Ch. Engr.—1,250 bbl., 5,000 bbl., 10,000 bbl., 25,000 bbl., 55,000 bbl. and 80,000 bbl. storage tanks, 10 x 30 ft. station tanks, agitators, miscellaneous small tanks, 10 x 30 ft. and 10 x 40 ft. stills, pipe stills, preheaters, exchangers for vapor and liquid, coolers, towers, condensers, pumps, compressors, machine tools and machinery.

Machinery Wanted

Calif., San Pablo—San Pablo Pottery Co., Inc.—machinery and equipment for proposed addition to works, including large kilns and presses (new).

Colo., Denver—Denver Custom Garment Co., 1517 Lawrence St., A. Johnson, Purch. Agt.—machinery for proposed factory.

Ill., Chicago—J. Drexler, 2263 Marmora Ave., (machinist)—air compressor, Gardner Rix, 2 stage, preferred.

Ill., Kankakee—The Kankakee Daily Republican—linotype, (No. 5 preferred).

Ill., Salem — The Republican, (newspaper)—one 30 in. power paper cutter.

Ind., Orland—A. D. Wells, (job printer)—one 25 to 28 in. power paper cutter.

Kan., Lincoln Center (Lincoln P. O.)—Brice Printing Co., O. A. Brice, Purch. Agt.—automatic press and a 32 in. paper cutter.

Kan., Wichita—J. W. Krebs, 341 North Millwood Ave. (planing mill)—belting, hangers, band saw and shafting.

Kan., Wichita—Peoples Finance Co., 124 East First St.—lumber saw mill, belting, band saw, log saw and other lumber equipment.

Mass., Southbridge — Hamilton Woolen Co.—machinery for addition to plant.

Mich., Detroit—Printers' Exchange, 2325 Grand River Ave.—power presses, 8 x 12 in. and 12 x 18 in.

Mich., Detroit — O. B. Whipple, 8011 Woodward Ave.—paper cutter, press and equipment for small print shop.

Minn., Bemidji — Minnesota Associated Lumber Co.—machinery for proposed lumber mill.

Minn., Minneapolis—The Star Laundry, 906 Hennepin Ave., G. M. Carter, Pres.—additional machinery and equipment for proposed laundry.

Minn., Monticello—Monticello Creamery Assn., A. H. Lauterbach, Secy.—complete set of equipment for new creamery, incl. 2 ripeners, one churn, one refrigerating machine, pumps, etc.

Neb., Lincoln—V. M. McVey, Brownell Bldg.—power presses, 10 x 15 in. and 12 x 18 in.

Neb., Nebraska City—The Press Printing Co.—wire stitcher, No. 5, either Boston or Monitor make.

N. H., Harrisville—Cheshire Mills (manufacturers of woolen goods)——machinery for addition to plant.

N. Y., Albany — The State Hospital Comn., receiving bids until Oct. 11 for additional laundry equipment for Utica State Hospital, Utica.

N. Y., Brooklyn—Rubel Coal & Ice Corp., Glenmore Ave.—ice making machinery for proposed plant.

N. Y., Buffalo—Angola Tire & Rubber Co., 270 North Division St.—machinery and equipment for proposed addition to factory.

N. Y., Buffalo—M. Lewis, 580 Ellicott Sq.—machinery and equipment for vinegar and pickle plant.

N. Y., Buffalo—W. Maynard Co., 17 Newell St.—equipment for abbatoir.

N. Y., Cheektowaga (Buffalo P. O.)—Live Poultry Transit Co., Bway.—machinery and equipment for proposed fertilizer and car repair plant at Forks.

N. Y., Elma Center—J. Geyers—equipment for blacksmith shop to replace that which was destroyed by fire.

N. Y., Jamestown—Herby Bros., 610 West 7th St.—additional mechanical equipment for proposed addition to wagon and automobile truck body factory and shop.

N. Y., Jamestown—Jamestown Chair Factory, 20 Winsor St.—woodworking machinery and equipment for proposed addition to factory.

N. Y., New York — Bd. of Purchase, Municipal Bldg.—receiving bids until Oct. 11 for laundry machinery.

N. Y., New York—Superior Ice Co., Inc., 50 East 42nd St.—ice making machinery for new plant at Sheepshead Bay.

N. Y., Oswego—Tioga Milk Producers' Assn.—machinery and equipment for new creamery and milk plant.

N. Y., Rochester—Electric Storage Battery Co., 181 South Clinton St.—machinery and equipment for proposed storage battery and products factory.

N. Y., Rome—Rome Wire Co., Railroad Ave.—machinery and equipment for proposed plant for the manufacture of cable wire, at Niagara Falls, Ont.

N. C., Speed—Edgecombe County School Bd.—vocational equipment for new school at Crisp.

O., Blanchester—Fulflo Specialties Co.—one belt driven, modern air compressor, 100 to 350 ft. at 100 lb. pressure.

O., Cleveland—G. T. Marks, 2197 East 82nd St.—woodworking machinery for pattern shop.

O., Columbus—General Fixture & Supply Co., 61 East Spring St. (manufacturer of refrigeration machinery), E. L. Farmer, Genl. Mgr.—woodworking machinery, including one groover, 2 planers, several drills, etc

O., Delaware — Sterling Stone & Lime Co., J. T. Herrick, Genl. Mgr.—machinery and equipment for proposed stone crushing plant, capacity 1,200 ton per day.

O., Middletown—Gardner-Harvey Paper Co.—machinery and equipment for proposed $150,000 addition to factory.

O., Ravenna—W. Sidevan, Coats Bldg.—one 8 x 12 in. and one 7 x 11 in. press, also other printshop equipment.

O., Warren—G. N. Anthony, 515 South Austin St.—5 ton wagon and truck scales.

Okla., Oklahoma City—Tower Gasoline Co., 212 Mercantile Bldg.—machinery and equipment for proposed addition to refinery at Blackwell, and also for proposed refinery and gasoline plant.

Pa., Beaver Falls—B. Keefer, 21st St. and 5th Ave.—machinery and equipment for carpenter and pattern shop.

Pa., Bellefonte—R. Smith—machinery and equipment for proposed addition to ice cream plant, 600 gal. capacity.

Pa., Bradford—A. Gillis, 1 Mechanic St.—engine and power machinery outfit for pumping two oil wells.

Pa., Clarion—Berney-Bond Glass Co.—machinery and equipment for proposed glass factory.

Pa., Easton—C. K. Williams & Co., (manufacturer of dry colors)—one rotary kiln, 8 ft. in diam. and about 85 ft. long, Vulcan type.

Pa., Kinzua—E. G. Anderson—machinery and equipment for sawmill to replace that which was destroyed by fire.

Pa., Lititz—The Stiffel & Freeman Co., Inc. (manufacturers of locks, safes, vaults, etc.)—machinery and equipment for proposed one story addition to factory.

Pa., Phila.—M. J. Hunt's Sons Co., 251 Richmond St., (steel fabricators)—double drum electric hoist, 5 ton capacity.

Pa., Phila.—Manvunk Plush Mfg. Co., 108 Levering St.—additional looms for proposed mill.

Pa., Phila.—Pennsylvania R.R., Broad St. Sta., M. Smith, Purch. Agt.—two 250 ton, six 15 ton, one 50 ton, two 25 ton and two 60 ton cranes.

Pa., Pittsburgh—W. H. Ritenour, 1315 West Liberty Ave. (job printers)—stereotype steam table.

Pa., Wilkes-Barre—The Candlemas Collieries Co., 713 Coal Exchange Bldg., N. Chrisman, Solicitor—machinery and equipment for mining, preparing and shipping of coal.

Pa., Williamsport—Demarset Silk Co., 606 Railway St.—machinery and equipment for proposed addition to silk factory.

Tenn., Chattanooga — Signal Mountain Mining Co., L. S. Berg, Genl. Mgr.—hoisting and conveying machinery and other equipment for development of coal properties in Suck Creek field.

Tenn., Nashville—Douglas Coal Mining Co., 504 Fourth and First National Bank Bldg., A. Lackel, Pres.—hoisting equipment, electrical machinery, dump cars, mine locomotives and other equipment for

development of coal mining properties near Island, Ky.

Tex., Galveston—Goliad School, 31st and L Sts., A. Brown, Purch. Agt.—complete line of tools for vocational school work.

Va., Richmond—L. R. Kelly, 215 East Marshall St.—battery charging outfit.

Va., Richmond—W. F. Lipford, 602 State St.—printing presses.

W. Va., Nitro—Nitro Pencil Co.—machinery to replace that which was destroyed by fire.

Wis., Colby—Colby Buick Co., c/o H. J. Cornelius—air tank and gas storage tank with pump.

Wis., Menomonie—Boothby Print Shop—No. 14 linotype.

Wis., North Milwaukee—North Milwaukee Fdry. Co., Commerce Ave.—cupola (new).

Wis., Milwaukee—A. C. Beck Co., 1 East St.—woodworking machinery, including band saws.

Wis., Potosi — Tennyson Co-operative Creamery Co., J. H. Schafer, Pres.—dairy machinery

Wis., Reeseville—The Reeseville Canning Co.—canning and conveying machinery, belting, shafting and hangers for proposed factory at Clyman.

Wis., Sheboygan—City Upholstering Co., 1542 Silbey Court, W. E. Ahrens, Mgr.—machinery for upholstering furniture.

Wis., Stevens Point—Stevens Point Cleaning & Dye Wks., 446 Clark St.—dyeing and cleaning machinery and equipment for proposed plant (new).

Wyo., Glenrock—Mutual Oil Co.—machinery and equipment for proposed addition to refineries here and at Cowley.

Ont., Paris—Penmans, Ltd.—machinery and equipment for the manufacture of woolen underwear.

Ont., Sarnia—Mueller Mfg. Co., H. Burleigh, Mgr.—machinery for the manufacture of special lines of plumbing goods, for proposed addition to plant.

Ont., Toronto — Surgis Baby Carriage Co., 60 Sumach St.—machinery and equipment for proposed factory at Brampton.

Metal Working Shops

Conn., Norwalk—The E. M. Jennings Co., 27 Harrison St., Bridgeport, awarded the contract for the construction of a 1 story, 55 x 155 ft. garage and service station, on West Ave., here. Estimated cost $40,000. Noted Aug. 29.

Ill., Elgin—F. D. Chase, Inc., Archt., 645 North Michigan Ave., Chicago, are receiving bids for the construction of a 3 story factory, on State and Schiller Sts., here, for Elgin Stove & Oven Co., 14 Chicago St. Estimated cost $100,000.

Ill., LaGrange—Fugard & Knapp, Archts., 212 East Superior Ave., Chicago, are receiving bids for the construction of a 1 story, 70 x 160 ft. garage, here, for Fleck & Buchholtz, 19 West Railroad St., Downers Grove. Estimated cost $50,000.

Ind., Alexandria — Ziegler Mfg. Co., manufacturer of metal stampings and screw machine products, is building a 1 story, 60 x 200 ft. addition to its factory.

Ind., Indianapolis—Indiana Battery Service Co., 1007 North Meridian St., is having plans prepared for the construction of a 1 story, 60 x 200 ft. automobile service station. Estimated cost $30,000. F. S. Cannon, 21 Virginia Ave., Archt.

Ind., Indianapolis—Rockwood Mfg. Co., 1801 English Ave., is having plans prepared for the construction of two 1 story machine shops, 100 x 200 ft. and 75 x 100 ft. Estimated cost $40,000. Mothershead & Fitton, 540 North Meridian Ave., Archts.

Ind., Richmond—Automotive Gear Co. is receiving bids for the construction of a 1 story, 400 x 600 ft. gear factory, on 8th St. Estimated cost $35,000. J. A. Mueller, Archt. Noted Sept. 7.

Ia., Des Moines—E. W. Nothstine is having plans prepared for the construction of a 6 story, 127 x 264 ft. garage, on 5th and Chestnut Sts. Estimated cost $300,000. Proudfoot, Bird & Rawson, 810 Hubbell Bldg., Archts.

Mass., Great Barrington — Whalen & Kastner awarded the contract for the construction of a 1 story, 70 x 140 ft. garage and service station. Estimated cost $42,000.

Mass., Roxbury (Boston P. O.)—The Albert Griffiths Saw Co., 30 Whittier St., plans to build a 1 story, 40 x 90 ft. addition to its factory, on Columbus Ave. Estimated cost $20,000. Private plans.

Mich., Dearborn—Ford Motor Co., Highland Park, has had plans prepared for the construction of a 1 story, 200 x 800 ft. experimental laboratory. A. Kahn, 1000 Marquette Bldg., Detroit, Engr.

Mich., Holland—Bd. Educ. is having plans revised for the construction of a 3 story, 110 x 160 ft. high school, including manual training department, laboratories, printing and machine shops, etc., on River Ave. Estimated cost $250,000. B. Parks & Son, Grand Rapids, Engrs. Robinson-Campau, 715 Michigan Trust Bldg., Grand Rapids, Archts.

Mich., Lansing—The Y. M. C. A., West Michigan St., is having preliminary plans prepared for the construction of a 5 story, 50 x 120 ft. building, including swimming pool, gymnasium, machine shop, etc., on West Allegan St. Estimated cost $400,000. J. Wilson, Secy. N. McMillan, 348 Madison Ave., New York City, Archt.

Minn., Buhl—The Hanna Ore Mining Co., 909 Fidelity Bldg., Duluth, awarded the contract for the construction of a 2 story, 80 x 106 ft. machine shop, a 2 story, 38 x 124 ft. warehouse and office building, a 1 story, 24 x 52 ft. garage, and a 2 story, 20 x 20 ft. oil house, at the Wabigon Mine, here. Estimated cost $115,000.

Mo., Kansas City—White Co., 2001 Grand Ave., awarded the contract for the construction of a 2 story, 100 x 250 ft. garage and sales building on 29th and Walnut Sts. Estimated cost $100,000.

N. J., Newark—Dept. of Streets and Public Improvements, City Hall, is preparing plans for the construction of a 2 story, 70 x 150 ft. addition to its garage on Franklin St. Estimated cost $175,000. Private plans.

N. Y., Bemus Point—J. B. White is having plans prepared for the construction of a 2 story garage and service station. Cost will exceed $40,000. Johnson & Ford, Fenton Bldg., Jamestown, Archts.

N. Y., Buffalo—Klepfer Bros., 1029 Main St., are receiving bids for the construction of a 2 story, 235 x 570 ft. automobile service and repair station. A. H. Hopkins, 447 Main St., Archt.

N. Y., New York—Dept. of Water Supply, Gas and Electricity, Municipal Bldg., plans to build a garage on East 24th St. and Ave. A. Estimated cost $50,000. Private plans.

O., Cincinnati—The J. A. Fay & Egan Co., John and Front Sts., is having revised plans prepared for the construction of a 1, 2 and 3 story machine shop with about 80,000 sq.ft. of floor space, on Paddock Rd. and Tennessee Ave. Estimated cost $400,000. C. M. Stegner, Archt. and Engr.

O., Cleveland—The Grabler Mfg. Co., 6565 Bway., manufacturer of automobile accessories, is having plans prepared for the construction of a 2 story, 60 x 160 ft. addition to its factory at 1401 East 40th St. Estimated cost $60,000. C. H. Foster, 1401 East 40th St., Mgr. H. E. Shimmin, 2031 Euclid Ave., Archt.

O., Cleveland—West Center Sales Co., West 30th St. and Lorain Ave., awarded the contract for the construction of a 2 story, 50 x 130 ft. garage. Estimated cost $40,000.

Pa., Manor—Amer. City Eng. Co., Peoples Bank Bldg., Pittsburgh, is receiving bids for the construction of a 1 story, 110 x 130 ft. machine shop and a 30 x 65 ft. foundry, here, for the Robertshaw Mfg. Co., Youngwood.

Pa., Monongahela—Keystone Garage is receiving bids for the construction of a 2 story, 60 x 200 ft. garage and service station. Estimated cost $50,000. C. K. Downer, 248 Boylston St., Boston, Mass., Archt. Noted Sept. 21.

Pa., Oil City—E. M. Bowen is receiving bids for the construction of a 3 story, 70 x 80 ft. automobile repair and service station. Estimated cost $45,000. W. H. Crosby, Masonic Bldg., Archt. Noted Sept. 28.

Pa., Phila.—The General Electric Co., River Rd., Schenectady, N. Y., is receiving bids for the construction of a 7 story, 140 x 175 ft. addition to its switch factory, on 7th St. and Willow Ave., here. Private plans.

Pa., Phila.—The Traylor Eng. Co., Broad St. and Lehigh Ave., awarded the contract for the construction of an 8 story, 124 x 205 ft. automobile factory. Estimated cost $455,000.

Pa., Pitcairn—Pennsylvania R.R., Broad St. Sta., Phila., will soon award the contract for the construction of a 62 x 107 ft. paint storage and airbrake shop, a 40 x 200 ft. rivet cutting building, a 103 x 424 ft. paint shop and bake oven, a 100 x 760 ft. freight car repair shop, a 14 x 26 ft. oil house, a 43 x 203 ft. store house and welfare building and a 16 x 31 ft. oxygen and acetylene storage building, all one story, here. Estimated cost $500,000. A. C. Shand, Broad St. Sta., Phila., Ch. Engr.

Pa., Pittsburgh—Hanlon Gregory Galvanizing Co., 24th St., is having plans prepared for the construction of a 1 story, 100 x 400 ft. factory, on 56th and Butler Sts. Estimated cost $100,000. J. E. Dwyer, Forbes Murray Bldg., Archt.

Pa., Scranton—T. F. Leonard Estate, 505 Lackawanna Ave., will receive bids about Nov. 1 for the construction of a 2 story, 80 x 130 ft. garage on Adams Ave. Estimated cost $40,000. Architect not announced.

R. I., Providence—Colvin Fdry. Co., 185 Globe St., awarded the contract for the construction of a 1 story, 100 x 100 ft. addition to its foundry. Estimated cost $75,000.

R. I., Providence—The Olneyville Realty Co., Inc., 18 Plainfield St., plans to build a 1 story garage and service station, with capacity for 70 cars. Estimated cost $40,000. Architect to be announced later.

Tenn., Knoxville—The Mahan-Kerr Motor Co., Market St., is having plans prepared for the construction of a 3 story, 90 x 100 ft. showroom and garage on Market and Cumberland Sts. Estimated cost $150,000. Barber & McMurry, Burnwell Bldg., Engrs. and Archts.

Wis., Colby—Colby Buick Co., c/o H. J. Cornelius, plans to build a 2 story, 50 x 80 ft. garage. Estimated cost $40,000. Architect not selected.

Wis., Milwaukee—The Luick Ice Cream Co., 183 Ogden St., is having preliminary plans prepared for the construction of a 2 story, 120 x 120 ft. garage, on Van Buren St. Estimated cost $75,000. Leenhouts & Guthrie, 424 Jefferson St., Archts.

Wis., Milwaukee—E. G. Schroeder Co., Engrs. and Archts., 405 Bway., is receiving bids for the construction of a 1 story, 130 x 150 ft. factory and office building, on Keefe Ave., for Milwaukee Air Power Pump Co., 886 3rd St.

Wis., Monroe—The United Telephone Co. plans to build a 2 story, 40 x 65 ft. garage, etc. Estimated cost $40,000. R. M. Austin, Mgr. Private plans.

Wis., North Milwaukee—The North Milwaukee Fdry. Co., Commerce Ave., plans to build a 1 story, 50 x 150 ft. foundry, to replace the one which was recently destroyed by fire.

Wis., Racine—F. J. Greene Eng. Wks., 1028 Douglas Ave., is having plans prepared for the construction of a 3 story, 53 x 100 ft. factory. Estimated cost $50,000. E. B. Funston Co., 503 Robinson Bldg., Archt.

Wis., Racine—Jacobson Auto Co., 1820 West 6th St., awarded the contract for the construction of a 2 story, 60 x 120 ft. garage. Estimated cost $40,000. Noted March 30.

Wis., Rhinelander—Wisconsin Regrinding Co., Sheboygan Falls, plans to build a 1 story, 50 x 90 ft. machine shop, here. Estimated cost $40,000. A. P. Schneidewind, Pres. Architect not selected.

Ont., London—Middlesex Motors, Ltd., 781 Dundas St., will receive bids Oct. 16 for the construction of a 75 x 200 ft. automobile service station and repair shop. Estimated cost $55,000. F. B. Isaacs, Mgr.

Ont., Niagara Falls—Rome Wire Co., Railroad Ave., Rome, N. Y., plans to build a 2 story, 40 x 250 ft. factory, here, for the manufacture of cable wire. Cost will exceed $75,000. Architect not announced.

Ont., St. Thomas—The Windsor Machine & Tool Co., 312 Pitt St., Windsor, plans to build a plant, here, for the manufacture of pistons and piston rings. Estimated cost $100,000.

Ont., Sarnia—Mueller Mfg. Co. plans to build an addition to its plant for the manufacture of special lines of plumbing goods. Estimated cost $100,000. H. Burleigh, Mgr.

General Manufacturing

Ala., Birmingham—Lehigh Portland Cement Co., Young Bldg., Allentown, Pa., plans to build a large plant on tract near here, with a capacity of 1,000,000 bbl. per year.

Calif., Petaluma—Poultry Producers of Central California, 323 East Washington St., will have plans revised for the construction of a 110 x 210 ft. packing plant. Noted Sept. 28.

Calif., Sacramento—The State of California awarded the contract for the construction of a 2 story, 160 x 160 ft. printing plant on 11th and O Sts. Estimated cost $94,800. Noted Aug. 29.

Calif., San Francisco—Ferro Bros., 2823 23rd St., have had plans prepared for the construction of a 2 story, 25 x 104 ft. addition to their bakery. C. Fantoni, 550 Montgomery St., Archt.

Calif., San Francisco—Millbrae Dairy, 834 Octavia St., is having plans prepared for the construction of a 2 and 3 story dairy, on McAllister St. near Laguna St. Estimated cost $100,000. J. Reid, Jr., First National Bank Bldg., Archt.

Conn., Stamford — Emmens & Abbott, Archts., Washington Bldg., are receiving bids for the construction of a 3 story, 75 x 100 ft. factory, for the manufacture of clothing, on Beckley Ave., for S. and J. Gruber, 544 Main St. Estimated cost $60,000.

Ga., Savannah—Western Paper Makers Chemical Co., River Rd., Kalamazoo, Mich., plans to build a paper mill, here. Estimated cost $500,000.

Ill., Chicago—Amer. Casket & Mfg. Co., 1317 West Division St., awarded the contract for the construction of a 3 story, 25 x 70 ft. addition to its factory. Estimated cost $30,000.

Ill., Chicago—The Enterprise Parlor Furniture Co., 2315 West Huron St., awarded the contract for the construction of a 3 story, 100 x 125 ft. addition to its factory. Estimated cost $50,000. Noted Sept. 14.

Ill., Chicago—Florence Art Co., c/o Minchin Spitz & Co., Archts., 19 West Jackson St., awarded the contract for the construction of a 4 story, 50 x 108 ft. factory for the manufacture of art lamps, on North California and George Sts. Estimated cost $125,000.

Ill., Chicago—Illinois Publishing Co., 327 West Madison St., awarded the contract for the construction of a 3 story, 125 x 240 ft. printing plant on 26th and LaSalle Sts. Estimated cost $500,000.

Ind., Evansville—General Cigar Co., Upper 2nd St., plans to construct a 4 story, 75 x 150 ft. cigar factory. Estimated cost $75,000. A. E. Neucks, Peoples Bank Bldg., Archt.

Ind., Hammond—Hammond Dairy Co. is having plans prepared for the construction of a 2 story, 53 x 70 x 153 ft. dairy building on Oakley St. Estimated cost $100,000. A. C. Berry & Co., Ruff Bldg., Archts.

Ind., Princeton—Tip Top Creamery Co. plans to build a 2 story creamery. Estimated cost $30,000. Architect not selected.

Ind., Richmond—Consumers Service Co. plans to build a 1 story refinery, will require 5 tanks of 100,000 gal. capacity. Estimated cost $200,000. Architect not selected.

Kan., Atchison—Blair Milling Co., 300 South 4th St., is receiving bids for the construction of a 6 story, 36 x 83 ft. flour mill. Horner & Wyatt, 306 McMillan Bldg., Kansas City, Mo., Archts.

Kan., Salina—H. D. Lee Flour Mills Co. awarded the contract for the construction of a cleaner house, temping bins, elevator, 8 tanks, 22 ft. diameter, capacity 300,000 bu. Estimated cost $190,000. Noted Aug. 24.

Me., Dexter—A. Abbott Co., manufacturer of woolens, plans to rebuild its 2 story plant which was recently destroyed by fire. Estimated cost $100,000.

Mass., Clinton—Lancaster Mills, 1 Green St., awarded the contract for the construction of a 1 story, 20 x 180 ft. addition to its woolen mill. Estimated cost $25,000.

Mass., Dorchester (Boston P. O.)—Liberty Marble Co. 80 Granite St., South Boston, will build a 1 and 2 story, 80 x 122 ft. marble shop, on Dillingham St. Estimated cost $25,000.

Mass., East Braintree, (Boston P. O.)—Massachusetts Oil & Refining Co., 209 Washington St., Boston, plans to build an oil separator plant on Quincy Ave., here. Estimated cost $50,000. Private plans.

Mass., Millbury—The Felters Co., West St., manufacturers of felt, plans to build a 1 story dyehouse. Private plans.

Mass., Northampton—Pomeroy Bros., 254 Pleasant St., awarded the contract for the construction of a 2 story, 60 x 80 ft. woodworking factory. Estimated cost $25,000.

Mass., Springfield—Victor-Wright-Ditson Co., Birnie Ave., awarded the contract for the construction of a 2 story, 60 x 150 ft. addition to its factory, for the manufacture of sporting goods. Estimated cost $12,000.

Mass., Worcester—Waldorf System, Inc., 169 High St., Boston, is having plans prepared for the construction of a 1 story bakery, etc., on Arch and Summer Sts., here. Estimated cost $40,000. J. M. Gray, 112 Water St., Boston, Archt.

Mich., Detroit—Kroger Grocery & Baking Co., 817 Main St., Cincinnati, O., awarded the contract for the construction of a 2 and 3 story, 203 x 424 ft. bakery and warehouse on Merritt Ave., here.

Mich., Three Oaks—The Warren Featherbone Co. has had plans prepared for the construction of a 2 story, 68 x 140 ft. factory. Estimated cost $45,000. G. W. Allen, Laporte, Ind., Archt.

Minn., Bemidji — Minnesota Associated Lumber Co. plans to build a large lumber mill for cutting and preparing 40,000,000 ft. of birch timber. Estimated cost $500,000. Architect not announced.

Minn., Chisholm—Bd. Educ. will receive bids about Dec. 1, for the construction of a 3 story junior high school, including manual training and industrial departments. Estimated cost $750,000. E. Drew, Clk. German & Jensen, Exch. Bank Bldg., Duluth, Archts.

N. Y., Batavia—P. W. Minor & Son, Inc., awarded the contract for the construction of a 4 story, 43 x 140 ft. addition to their shoe factory, on State St. Estimated cost $100,000.

N. Y., Brooklyn — The United Last Co., 191 Worth St., New York City, awarded the contract for the construction of a 3 story, 80 x 131 ft. and a 1 story, 16 x 50 ft. additions on Classon Ave. and Clifton Pl., here.

N. Y., Brooklyn—The Rubel Coal & Ice Corp., Glenmore Ave., will build an ice plant on Atlantic Ave. Estimated cost $500,000. E. M. Adelsohn, 1778 Pitkin Ave., Engr.

N. Y., Buffalo—Angola Tire & Rubber Co., 270 North Division St., awarded the contract for the construction of a 1 story, 30 x 80 ft. addition to its factory. Cost will exceed $5,000.

N. Y., Buffalo — W. Maynard Co., 17 Newell St., plans to build a 2 story, 60 x 100 ft. abbattoir. Estimated cost $40,000. Architect not announced.

N. Y., Forks—The Live Poultry Transit Co., Bway., Cheektowaga (Buffalo P. O.), plans to rebuild its fertilizer and car repair plant, here, which was destroyed by fire. Estimated cost $100,000. Architect not selected.

N. Y., Jamestown—Herby Bros., 610 West 7th St., plan to build an addition to their wagon and automobile truck body factory and shop. Estimated cost $5,000. Private plans.

N. Y., Jamestown — Jamestown Chair Factory, 20 Winsor St., plans to build a 4 story, 50 x 67 ft. addition to its factory. Estimated cost $20,000. Architect not announced.

N. Y., Jamestown—Jamestown Worsted Mills Co., 335 Harrison St., is having plans prepared for the construction of a 4 story, 70 x 180 ft. factory (No. 16). Estimated cost $250,000. Lockwood, Greene & Co., 1556 Hanna Bldg., Cleveland, O., Archts. and Engrs.

N. Y., North Tonawanda — The Auto Wheel Coaster Co., manufacturer of coaster wagons and sleds, plans to rebuild portion of its factory, on Schenk St., which was destroyed by fire. Estimated cost $25,000. Architect not announced.

N. Y., Rochester—Don-O-Lak Co. plans to rebuild portion of its paint and varnish factory which was destroyed by fire. Estimated cost $50,000. Architect not announced.

N. Y., Sheepshead Bay (Brooklyn P. O.) —Superior Ice Co., Inc., 50 East 42nd St., New York City, is having plans prepared for the construction of an ice plant, on Ave. Z and East 17th St., here. Estimated cost $250,000. W. Mortensen, 209 West 76th St., New York City, Archt. and Engr.

O., Cleveland—M. Braduloo, 9123 Laisy Ave., (baker), awarded the contract for the construction of a 1 and 2 story, 68 x 109 ft. commercial building and bakery on East 116th St. and Buckeye Rd. Estimated cost $45,000.

O., Cleveland—J. O. Stein & Co., (real estate), 822 Leader-News Bldg., awarded the contract for the construction of a 2 story, 35 x 50 ft. ice cream factory, at 10521 Superior Ave. Part of building is leased to the Hoffman Ice Cream Co., 10521 Superior Ave. Estimated cost $40,000.

O., Cleveland—The Van Gastel Cleaning Co., 2420 Cedar Ave., plans to build a 1 and 2 story dry cleaning plant. Estimated cost $75,000. H. Van Gastel, Mgr. Architect not selected.

O., Columbus — The Columbus Varnish Co., 262 Cozzens St., is having sketches made for the construction of a 1 story, 100 x 300 ft. addition to its factory. Estimated cost $40,000. Jones & Abernethy, Dispatch Annex, Engrs. and Archts.

O., Mansfield—Dept. Public Welfare, Oak and 9th Sts., Columbus, is having plans prepared for the construction of a 2 story industrial building at the Mansfield Reformatory, here. Estimated cost $150,000. R. S. Harsh, Ohio-Hartman Bldg., Columbus, Archt.

Pa., Brackenridge — Atlantic Bottle Co., Brackenridge, and 90 West Bway, New York City, plans to rebuild its factory, here, which was recently destroyed by fire. Estimated cost $300,000. Architect not announced.

Pa., Clarion—Berney-Bond Glass Co. plans to rebuild its facory which was recently destroyed by fire. Estimated cost $400,000. Architect not announced.

Pa., McKees Rocks—The Chesebrough Mfg. Co., 17 State St., New York City, manufacturers of vaseline, will soon award the contract for the construction of a plant, consisting of seven buildings, including a power house, boiler house, warehouse and manufacturing buildings, here. Estimated cost $1,000,000. Hunting Davis Co., Century Bldg., Pittsburgh, Archts. Noted June 8.

Pa., Phila.—Harrison Brush Co., 4th and Arch Sts., awarded the contract for the construction of a 3 story, 30 x 110 ft. factory for the manufacture of brushes, at 4712-14 Market St. Estimated cost $80,000.

Pa., Pittsburgh—The Atlantic & Pacific Tea Co., 309 Carson St., awarded the contract for the construction of a 4 story, 75 x 120 ft. bakery on Dallas Ave. and Lynn Way.

Pa., Warren—C. Hamm, 28 Clark St., plans to rebuild portion of woodworking shop which was destroyed by fire. Estimated cost $30,000.

R. I., East Providence—Atlantic Refining Co., 715 Hospital Trust Bldg., Providence, is having plans prepared for the construction of a receiving and distributing oil plant, including 20 large storage tanks, pump houses, garages, etc., at Kettle Point off Barrington Parkway, here. Private plans.

R. I., Manville — The Manville Co. awarded the contract for the construction of a 1 and 2 story addition to its plant for the manufacture of cotton goods. Estimated cost $100,000.

R. I., Pawtucket—J. and P. Coats, Inc., 366 Pine St., will soon award the contract for the construction of 2 and 3 story, 95 x 370 ft. and 95 x 270 ft. mill buildings, for the manufacture of thread, etc. Estimated cost $375,000. Private plans.

R. I., Wakefield—Wakefield Textile Mills awarded the contract for the construction of a 2 story, 45 x 80 ft. addition to their woolen mill, including picker room building and dyehouse. Estimated cost $25,000.

S. C., Greenville—Judson Mills, Community Bldg., manufacturers of cotton goods, is having plans prepared for the construction of a 2 story, 175 x 300 ft. textile mill. Estimated cost $600,000. J. E. Sirrine Co., South Main St., Archts.

Tenn., Kingsport—Mead Fibre Co. plans to build a large paper mill. Estimated cost $750,000. Management Eng. & Development Co., c/o owner, Engrs.

W. Va., Nitro—Nitro Pencil Co. plans to rebuild its pencil factory which was destroyed by fire. Estimated cost $90,000. Architect not announced.

W. Va., Charleston—The Owens Bottle Co., 1401 Nicholas Bldg., Toledo, O., is having plans prepared for the construction of a 1 story, 300 x 360 ft. addition to its factory, here. Estimated cost $150,000. The Devore Co., 908 Nicholas Bldg., Toledo, O., Engrs. and Archts.

Wis., Brillion—Calumet Canning Co. plans to build a 2 story, 50 x 110 ft. canning factory, here. Estimated cost $45,000. J. E. De Master, 623 End Court, Sheboygan, Pres. Private plans.

Wis., Crandon—The Vulcan Last Co. plans to rebuild its 2 story, 60 x 120 ft. shoe factory, which was recently destroyed by fire. Architect not selected.

Wis., Oconto—Elsnore Veneer Co., Conneaut, O., plans to build a 1 story, 50 x 90 ft. veneer factory, here. Estimated cost $30,000. H. A. Truesdale, Local Mgr. Private plans.

Wis., Sheboygan—The Ke-No Mfg. Co., Pennsylvania Ave. and North Water St., awarded the contract for the construction of a 3 story, 40 x 80 ft. factory for the manufacture of novelties, on Water St. Estimated cost $30,000.

Wis., Union Grove—State Bd. of Control, M. J. Tappins, Secy., 902 Garfield St., Madison, will receive bids until Oct. 3, for the construction of a 1 story, 50 x 90 ft. laundry at the Wisconsin Home for Feeble Minded, here. Estimated cost $40,000. A. Peabody, Capital Bldg., Madison, Archts.

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How the Black & Decker Drill Is Built

Machining on Automatic Turret Lathes—Shaping and Hobbing Gears—Successful and Unsuccessful Fixtures—Heat-Treatment—Testing by Prony Brake

BY S. ASHTON HAND
Associate Editor, *American Machinist*

WHILE the component parts of portable electric drills require good workmanship, the amount of labor necessary in their production is comparatively small owing to the use of automatic machines.

One of the drills made by the Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md., is shown disassembled in Fig. 1.

The field case, gear case and gear-case cover are aluminum castings. The outside of the field case is hexagonal in shape except at the ends which are round.

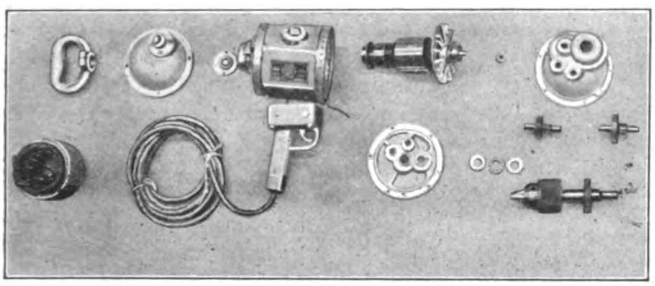


FIG. 1—PARTS OF THE BLACK & DECKER DRILL

This shape, with the round interior, gives greater strength with the same amount of metal than would be the case if the case were round both inside and outside and provides extra thickness of metal at the corners of the hexagon. If the drill were dropped it would probably strike on one of the corners where the greater thickness of metal would protect it against injury.

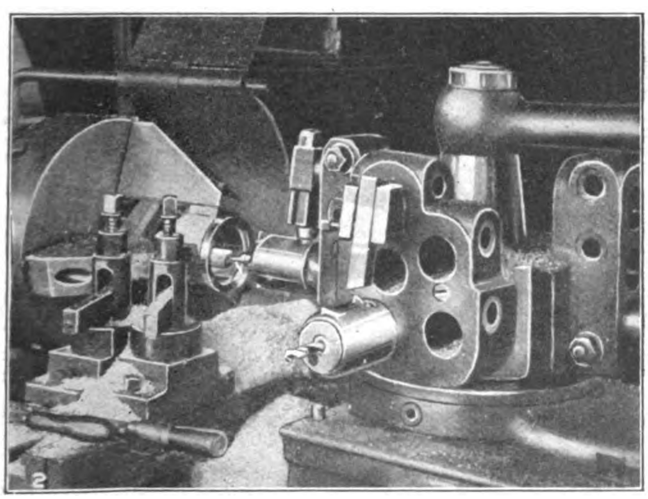
The hexagonal shape of the field case is an aid in its machining as the flat sides of the hexagon form excellent bearings for chuck jaws and but little pressure is required in chucking, as the wide bearing of the chuck jaws on the flats prevents the case from turning, consequently the danger of distortion from tight squeezing in the chuck is greatly eliminated.

Field cases are machined on Potter & Johnson automatic turret lathes as shown in Fig. 2. Rough- and finish-boring, turning and facing, together with spotting, drilling and reaming the central hole at the rear are all done in one chucking at the rate of 150 in 8½ hours.

Gear cases and covers are likewise turned and faced in Potter & Johnson machines. Fig. 3 shows a gear-case cover in the chuck and the tool set-up in the turret and on the toolslides of the carriage.

Drilling a field case for attaching gear cases and covers is done on a Natco multiple-spindle drilling machine as shown in Fig. 4. In operation, the field case is located by a pilot on the fixture *A*. The jig plate *B* is lowered simultaneously with the drilling head until it rests on the work. Further lowering of the drilling head to bring the drills into action, compresses the springs *C* and *D*, pressing the jig plate down on the work and holding it firmly in position. The production is 500 in 8½ hours.

As the armature runs at a very much higher speed than the spindle it is necessary to make considerable reduction between the two and as the space in the gear case is limited, the gears are compounded. In order that the gears shall run as noiselessly as possible the center distances of the holes in the gear case must be very accurate. The jig shown at *A*, Fig. 5, was made for drilling and reaming the holes to receive the bronze bushings that act as bearings for the gear shafts, the hole in the center of the gear case being bored and reamed at the time the case is turned, recessed and



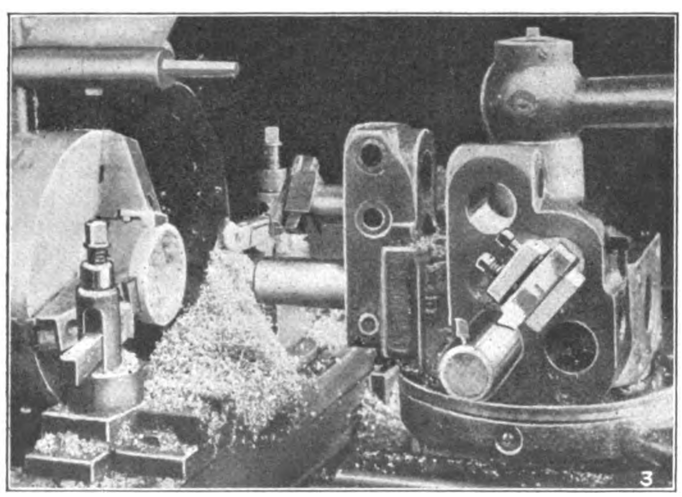
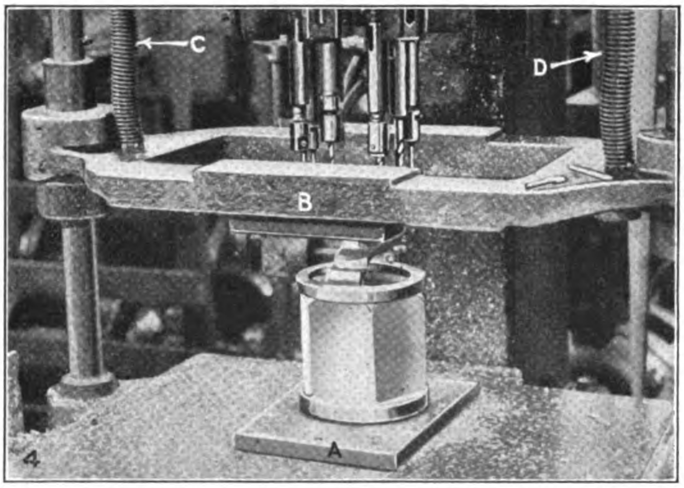


FIG. 2—MACHINING FIELD CASES. FIG. 3—MACHINING GEAR-CASE COVERS



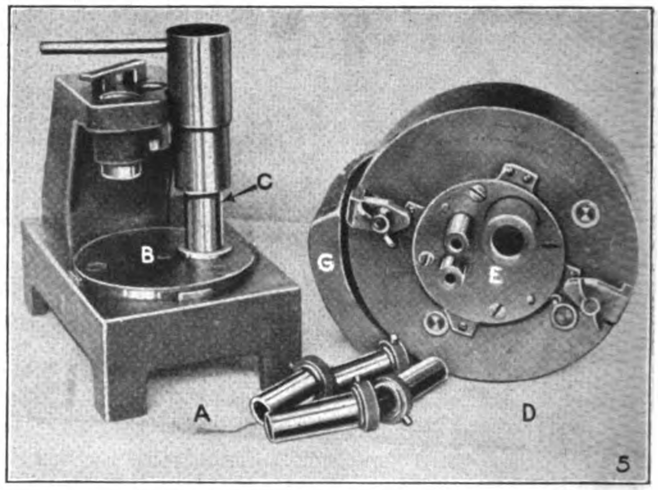


FIG. 4—DRILLING FIELD CASES. FIG. 5—FIXTURES FOR BORING GEAR CASES

faced. Notwithstanding that the jig was made with great care and that the work was located on the pilot *B* and held by the snug fitting, hardened and ground, plug *C*, through a hole previously drilled and reamed, the jig did not produce work having the accuracy demanded. The jig failed in its mission because it was impossible to have drills and reamers fit tightly enough

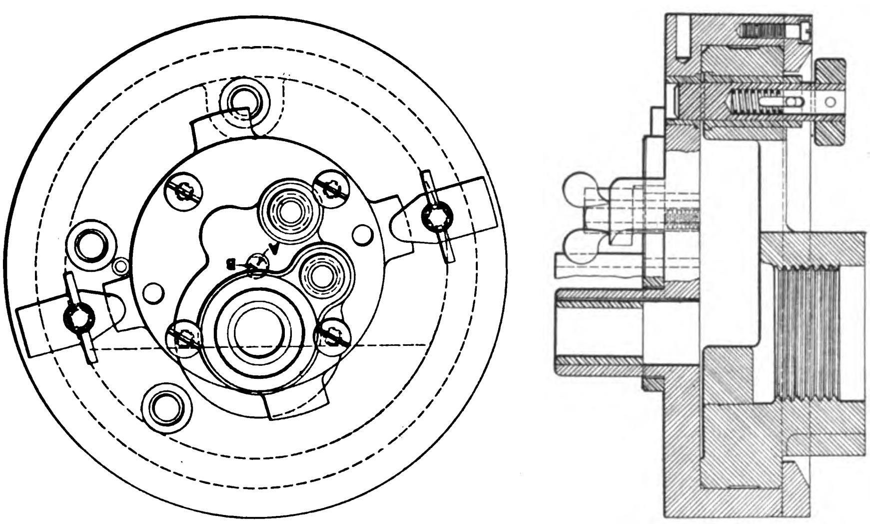


FIG. 6—DETAILS OF FIXTURE FOR BORING GEAR CASES

in the bushings to prevent more or less crowding to one side or the other while doing the work.

It was then decided to make a fixture for drilling and reaming the holes and to mount it on the spindle of a turret lathe so that the work would revolve and the tools remain stationary, except for motion in the direction of feed. Accordingly the fixture *D*, Fig. 5, was made and has given satisfactory results. The work is located on the pilot *E* and held by the clamps shown.

To insure further accuracy, the turret tools for boring and reaming are piloted in the bushings to be seen projecting from the work pilot *E*. As the holes in the work are grouped, though not equidistantly, about the center it is necessary to mount the fixture eccentrically on the machine spindle and to counterbalance it by the weight *G* to overcome vibration.

The whole front of the fixture is indexed for the holes around a plug, and held in any one of the desired positions by an index pin at the rear.

As previously stated the centers of the holes in the work are not equidistant from the center of the fixture and these unequal distances render it necessary to locate the pilot *E* out of the center so as to bring the centers of the holes equidistant from the indexing center.

Details of the fixture are given in the line drawing, Fig. 6, where *A* represents the center of the pilot and *B* the center of indexing.

All the holes are bushed with bronze to make good wearing bearings for the gear shafts. The bushings are made in a Cleveland automatic screw machine with magazine attachment as shown in Fig. 7, where they can be seen in the magazine at *A*. The blanks are double the length required and are drilled, reamed and rough-turned for one-half of their length, then reversed in the magazine when the former operations are repeated and the blanks cut in half, each blank making two bushings. The operations of the machine are entirely automatic, the only work required on the part of the operator being to keep the magazine loaded. The outside diameters of the bushings are finish-turned in a subsequent operation.

Pinions and gears all have stub teeth and are cut either on Fellows gear shapers or on Barber-Coleman hobbing machines, operations on the former being shown in Fig. 8 and on the latter in Fig. 9.

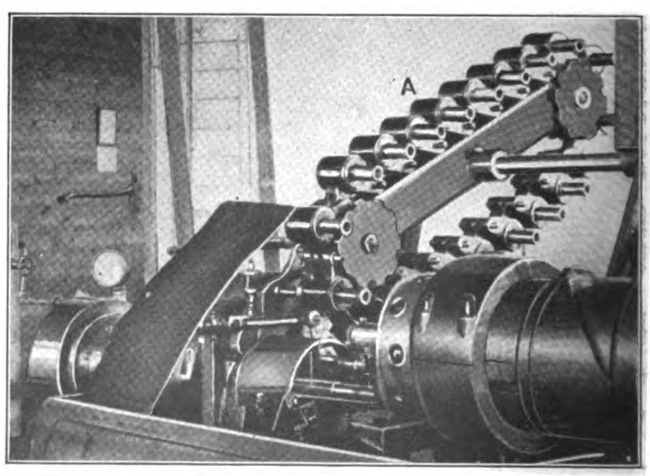
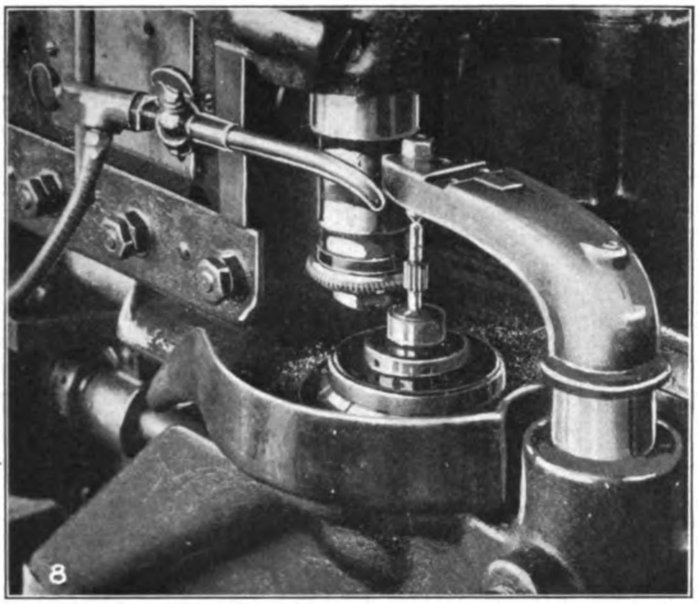


FIG. 7—MAKING BEARING BUSHINGS



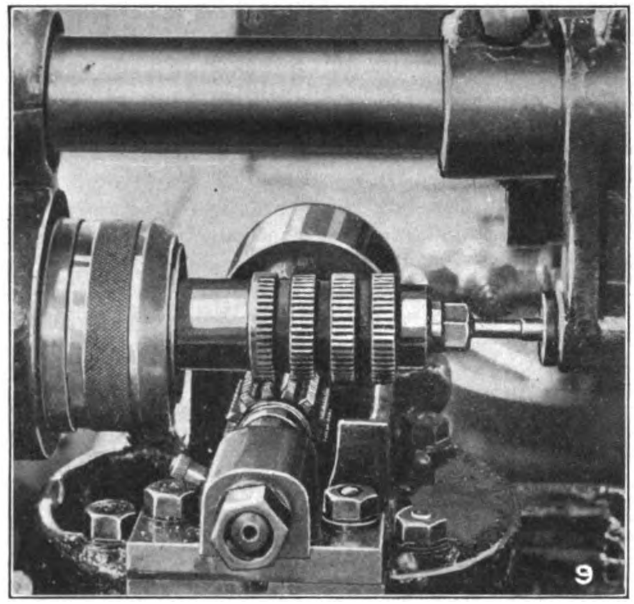


FIG. 8—CUTTING PINIONS. FIG. 9—HOBBING GEARS

Gear and pinion blanks are made from bar stock in automatic machines. All pinions, except the armature pinion, are integral with their shafts, the armature pinion being internally threaded and screwed on to the armature shaft. As before stated, the gears are compounded, a gear being mounted on each pinion shaft and arranged in the gear case in the same way as the gears in a clock or watch. The gear seats on the pinion shafts are knurled to make the gears a tight fit when pressed on.

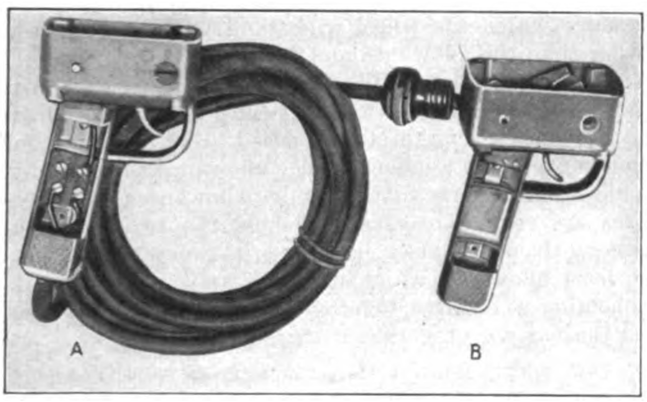


FIG. 10—SWITCH HANDLES

The gears and all other steel parts are heat-treated, being brought to temperatures suited to the work they have to perform and then quenched in oil and drawn by holding them in molten saltpeter for 10 min. and finally quenched in water. The average heat for the first treating is 1,450 deg. F., and for drawing in saltpeter, 750 deg. F. Before heating, all parts are washed in soda water to remove the grease and to prevent the formation of scale.

The switch handles shown in Fig. 10 are die-cast

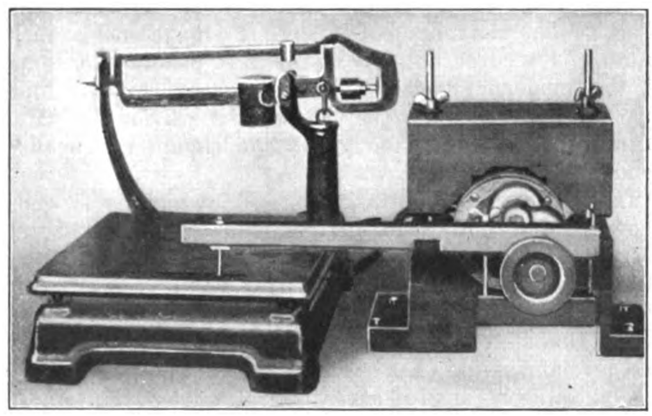


FIG. 12—WEIGHING THE LOAD

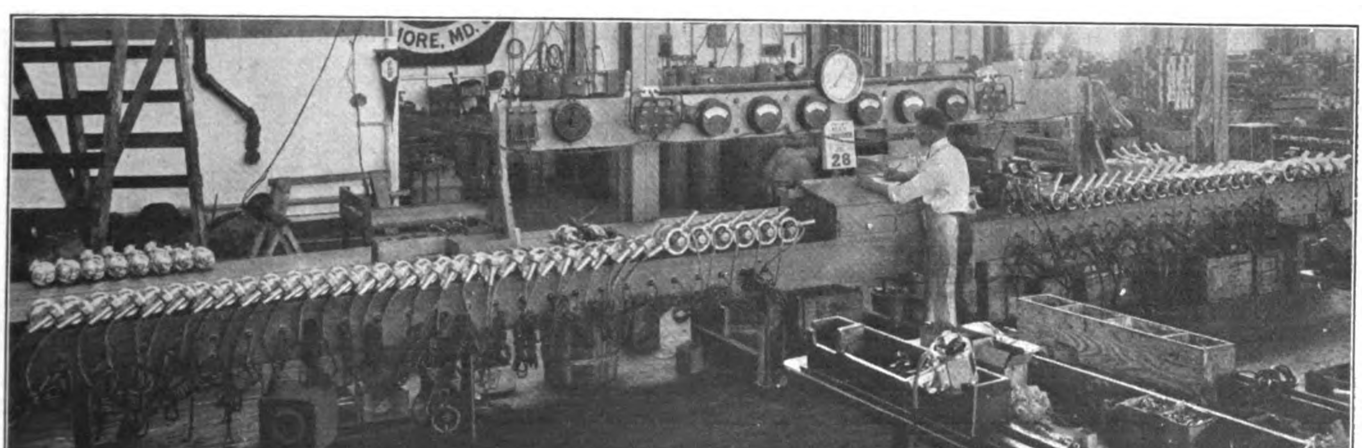


FIG. 11—THE RUNNING TEST

aluminum, the one at *A* having the wiring and insulating blocks in place while the one at *B* has not.

Electrical connection to the motor is made or broken by pressing the trigger which imparts a quarter turn to an insulated block spanned by brushes and having contacts on two opposite sides. The brushes are long and the block on which they are mounted is pivoted so that their tension is equal on both sides of the revolving block. All leads and wires are conected by screws and as no solder is used, the wires can be connected or disconnected by the use of a screwdriver.

The ball retainers for the thrust bearings are made from brass rod on a Brown & Sharpe automatic screw machine and then jig drilled for the ball pockets. The thrust washers are made from steel bars, hardened and then ground on a Heald rotary surface grinder, being held on a magnetic chuck.

All drills are run on a test for 2 hr. on the bench, shown in Fig. 11, which holds about 150 drills when fully loaded. After the running test each drill is given a brake test by the small Prony brake shown in Fig. 12. The length of the brake lever is 1 ft. from the center of the pulley to the center of the screw that bears on the scale platform. To pass this test the drill must deliver the full rated power without slackening in speed when the scale beam tips at 5 pounds.

The brake is lined with brake lining so that it is not necessary to use any oil.

The armatures and field coils are purchased from outside so that no electrical winding is done on the premises.

Samples of the insulated wire furnished with the drills are given periodic practical tests for the ability of the insulation to stand up under great abuse. For instance one sample of wire was laid across the roadway where it would be subject to all kinds of weather and to being run over by automobiles and heavily loaded trucks. This wire was put out in November, 1921, and tested weekly for breakage and leakage. In April, 1922, it was still in good working condition.

Forced and Shrink Fits—Discussion

By Frank C. Hudson

On page 210 of *American Machinist*, W. S. Standiford gives allowances for press and shrink fits which are so much greater than usual practice as to attract my attention immediately. They seem to average about double the usual allowance so, in order to make sure that the practice has not changed enough to make me a back number, I secured data as to the best practice of some of the modern shops. These data seem to bear out my impression that the allowances given by Mr. Standiford are much too great and should not be depended on for average work.

The Nordberg Manufacturing Co., which is a well-known builder of large engines and air compressors, uses 0.001 to 0.0015 in. per inch of diameter up to a 12-in. shaft. Above 12 in. it uses 0.001 in. per inch of diameter.

The Chandler & Price Co., makers of printing presses in Cleveland, Ohio, has smaller sizes. Its table is of special value because it gives both diameter and length of hole as well as the pressure required. It should be noted that the table gives total pressure and total oversize allowance on the shaft. The table is as follows:

Table of Force Fits and Pressures

5 tons pressure

Diameter of hole	Length	Oversize of shaft
2½ in.	3 in.	0.003 in.
3 in.	3½ in.	0.003 in.
3¼ in.	3¾ in.	0.003 in.

3 tons pressure

Diameter of hole	Length	Oversize of shaft
2½ in.	3 in.	0.002 in.
3 in.	3½ in.	0.002 in.
3¼ in.	3¾ in.	0.002 in.

A well-known railroad, which does not wish to be quoted, gives $\frac{1}{80}$ in. per foot of diameter for shrinkage of tires on its older locomotives, and $\frac{1}{64}$ in. per foot of diameter on the newer and heavier power. These are, of course, shrink fits.

In only one case, that of a locomotive shop which also desires to remain incognito, do I find allowances as great as those proposed by Mr. Standiford. On cast-iron wheels the allowance varies rather erratically from 0.002 in. per inch of diameter on a 2-in. bore, to nearly 0.003 in. per inch on a 7-in. bore and back to 0.002 in. on a 12-in. bore. The pressures given vary from 7 to 9 tons per inch of diameter.

For cast-steel or rolled-steel wheels the allowance is increased to 0.005 in. per inch for a 2-in. bore, but drops back to 0.003 in. per inch for a 7-in. bore and to a trifle over 0.002 in. per inch for a 12-in. bore. Pressures run from 11 to 15 tons per inch of diameter. These allowances seem to be based on the amount of pressure which the wheel will stand without bursting, rather than the allowance and pressure required to hold them on the axles. These figures indicate that Mr. Standiford's allowances may not come as near to bursting the piece as might be supposed. But the fact that other makers use a much smaller allowance successfully, would seem to show that excessive allowances and pressures are seldom necessary to hold the two parts together. It is certainly desirable in every way to use the least allowance which will give satisfactory results in holding the parts together. This reduces stresses and the parts go together more easily.

Use of Double-Acting Machines

By Robert Grimshaw

If the double-acting steam engine is a step in advance from the single-acting, why not apply the same principle wherever practicable? We already see the advantage of the double-acting wire-nail machine, the heavy recoil of which, after heading one nail, is not taken up uselessly in the bearings, but utilized in making another nail at the other end of the machine. Of course, owing to the necessity of putting in fresh coils of wire, and of sharpening, replacing or adjusting the cutting-off bits and the heading dies, the capacity of the double-acting nail machine is not twice that of the single on the same size product and with the same length of wire in all the spools. But the difference in labor cost and power consumption per product unit is marked, and pays.

The metal planer seems to me to be the best subject for thorough experiments in double acting. I think that the "jack-in-a-box" tool, such as one finds once in a while in Great Britain, might be used to advantage, with the same table speed—that at present used in cutting—in both directions. This would also diminish the jar occurring at present at the end of the back trip.

Methods of Machine Tool Design

Further Continuation of the Section on Feed Mechanism—Concluding the Discussion of Lead Screws—Various Types of Feed Screw Nuts—Thrust Bearings

By A. L. DE LEEUW
Consulting Editor, *American Machinist*

A PECULIAR use is made of the feed screw in connection with hydraulic feed. For the very heaviest kind of turning and boring, feed pressures are required beyond the capacity of a screw of practicable size. Generally speaking there is, of course, no reason why a screw could not be used with a diameter of 10 ft., but practical considerations such as the size of bearings, nuts, especially if half nuts are used, etc., limit the size. On the other hand, it is a very simple matter to obtain almost any feed pressure by means of hydraulic apparatus. If, for instance, water were used under a pressure of 1,000 lb. to the square inch, which is a very moderate pressure for a hydraulic cylinder, and if a feed pressure of 300,000 lb. were required, which is very high, it would be necessary only to have a hydraulic cylinder with an area of bore of 300 sq.in. which requires about a 10-in. bore. On the other hand, it is exceedingly difficult to regulate the amount of advance per minute when using hydraulic pressure. Differences in sharpness of the tool, size of cut, and nature of the material, would make the tool advance sometimes fast, sometimes slow, and it would be practically impossible to keep the advance uniform under all conditions of the cut.

The Use of an Auxiliary Mechanism

When it is necessary, then, to use hydraulic apparatus in order to obtain the required pressure, some auxiliary mechanism should also be used to regulate the speed of advance. A mechanism of this kind might be called a releasing mechanism, because it will hold back the action of the hydraulic pressure until this mechanism is set in motion and then it permits the hydraulic piston to advance at a speed determined by the speed of this auxiliary mechanism. One interesting way of obtaining this result is the following: An extension of the piston of the hydraulic cylinder is provided at one end with a steep screw thread. By some means or other the piston is prevented from turning. As this piston advances the screw thread must pass through its nut and, of course, cannot do so without rotating it. By making the angle of spiral of the thread greater than the friction angle it is possible to have the screw overhaul the nut. If the angle of the thread were very close to the friction angle, say a few minutes only, it would be able to drive the nut; but a small resistance brought to bear against the nut would prevent it from turning and would stall the piston. If this resistance were released—that is, if the nut were permitted to turn—the piston would advance and the full pressure of the hydraulic cylinder would be exerted against the member driven by the piston.

It is, of course, exceedingly difficult to determine beforehand exactly what angle should be used, particularly so as the conditions of metal of screw and nut cannot be predicted. There might be a difference of several degress in the friction angle between two screws and nuts made of the same material. In order to overcome this difficulty the spiral angle is made large enough to be certain that it exceeds this friction angle; and to overcome the difficulty which then arises, namely that considerable pressure must be brought to bear against the nut in order to keep it from rotating, the following method is applied:

The outside of the nut is made into a wormwheel and the angle of the teeth is such that it will overhaul the worm. To be sure again that the angle of the teeth will be sufficient, a reasonable excess is allowed, so that one will be sure that the angle is more and never less than the friction angle. Instead of applying the resistance against the nut, we now apply the resistance against the worm. The fact that we have allowed for a certain excess of angle in the screw may cause the nut to require a resistance of quite an appreciable percentage of the total load. However, it is well possible to keep this percentage down to less than 10. In that case, a resistance of 10 per cent of 300,000 or 30,000 lb. would be required at the diameter of the thread; or, let us say, 20,000 lb. at the outside of the nut or the pitch diameter of the wormwheel.

Allowing again for an excess of 10 per cent, we would then have to apply a resistance of 2,000 lb. to a diameter equal to the pitch diameter of the worm, or of 1,000 lb. to a diameter twice as great. A positive feed mechanism can be arranged giving all the necessary feeds required for the machine, and of which the last member is not directly applied to the carriage or boring head, but to a disk or gear or some member keyed to the shaft of the worm. The pressure required at that point being only 1,000 lb. can easily be supplied by the positive feed mechanism.

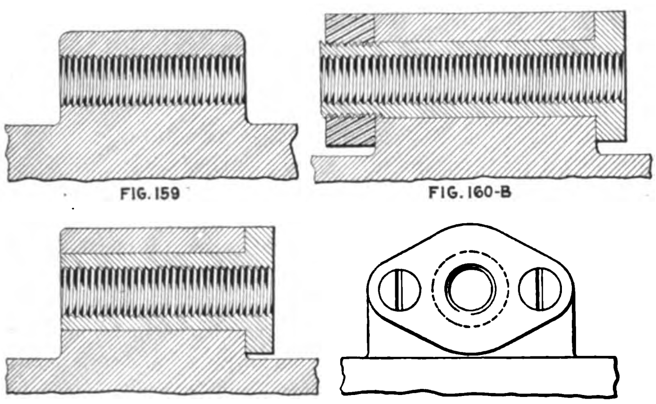
Allows for Ample Pressure

So long as the pressure in the hydraulic cylinder is sufficient to make the tool penetrate the amount prescribed by the positive feed mechanism, the feed will be uniform; but if the hydraulic pressure is not sufficient to cause the tool to penetrate, then the positive feed mechanism would have to supply the additional feed pressure required. As this might be quite considerable, it is advisable to allow for a rather large excess of hydraulic pressure so that at all times there shall be enough pressure for the penetration of the tools. Mechanisms of this kind have been successfully applied to large ingot boring and turning lathes.

In the previous paragraphs mention has been made of the desirability of large lead for feed screws. The amount of lead depended to a certain extent on the diameter of the screw, the essential requirement being that the angle of spiral should be rather large. When a screw is used as lead screw there is another requirement of equal importance, especially if the screw is used for thread cutting.

If a lead screw were made with 1-in. lead and we had to cut threads of 1, 2, 3, 4, 5, 6, pitch, and if we used the open and closed nuts, we would have the following condition: The operator throws the nut in, takes the first cut, throws the nut out at the end of the cut, returns the carriage, sets the tool in a certain distance, and throws the half nut in again. It makes

no difference what time he throws this half nut in, he is bound to catch the thread again which he has cut. Suppose the nut had been thrown in for the first cut in such a position that a thread which we will call A is in the center of the nut, and suppose we call the threads to the right of this $A + 1$, $A + 2$, $A + 3$, etc.; and to the left $A - 1$, $A - 2$, $A - 3$, etc. Suppose, then, that we should have thrown the nut in on the second pass in such a manner that thread $+ 2$ had come in the center of the nut; then this would simply mean that two complete revolutions of the screw are required before things are in the same condition again as on the first pass. The same thing would have happened if we had thrown it in on $- 2$, provided, of course, that there was room enough between tool and work to make such a thing possible. Speaking in general, the lead of the screw should be a multiple of all the different leads to be cut in order to make it possible to throw a half nut in without any precautions. This means that the lead must be either 1 in. or a multiple. If the lead were ½ in. it would have produced the same result when we throw the nut in on $+ 2$, but not when we throw it



FIGS. 159 AND 160—FORMS OF LEAD SCREW NUT CONSTRUCTION

in on $+ 1$ or $+ 3$, because this would have the tool brought to the right ½ in. or 1½ in. and this is not a multiple of the lead to be cut. This lead of ½ in. would have been all right for ½ in. or ¼ in. or ⅛ in. or ⅛ in. pitch, but not for ⅓ in. or ⅕ in. or ⅐ in. pitch.

Giving the lead screw a lead of 1 in. meets all commercial threads except 11½ per inch. This thread also might be included if the lead of the screw were 2 in. but, as a rule, this is too much for moderate sized lathes on which threads of 11½ to the inch are apt to be cut. The common practice of making lead screws with ¼ in., ⅓ in. or ½ in. lead should be discouraged, as it is very well possible, even in moderate sized lathes, to give the screw a lead, though not necessarily a pitch, of 1 in.

The simplest way to construct a nut for feed or lead screw is to cast a lug to the member to be moved and tap it out to suit the screw. Though this may be the simplest in principle, it is not necessarily the simplest in execution because it may be difficult to get at the nut for tapping. Besides, merely tapping a hole would not be satisfactory for larger or more accurate work and where the nut is made in one with a large casting it becomes exceedingly difficult to chase it in a lathe. Fig. 159 shows this simple construction. Fig. 160 A shows a better construction. Here the lug of the casting is merely bored out and faced. The nut is made cylindrical in form and provided with a flange so that it can be bolted on to the lug of the main casting. It is possible now to turn this nut and chase it in the lathe and for a higher degree of accuracy it can be put on a threaded arbor and finish-turned or ground from

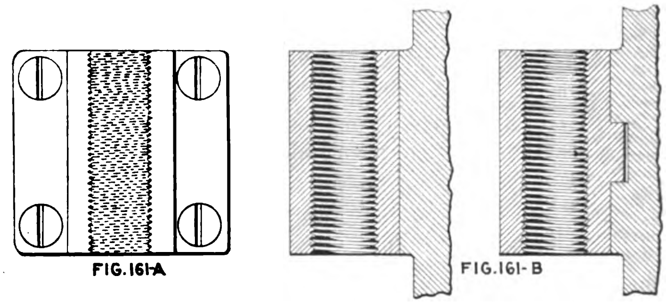


FIG. 161—BOLTED-ON LEAD SCREW NUT

the thread, so that there is a reasonable assurance that the thread will be concentric and in line with the bored hole in the lug.

Fig. 160 B shows the same construction with the exception that a collar has been provided at the end of the nut opposite the flange. When pressure occurs in one direction only, or when the pressure in the opposite direction is always light, a construction such as shown in Fig. 160 A is satisfactory; but when there is a possibility that heavy pressure may be exerted in the opposite direction, then it is not safe to rely on the necessarily small screws which hold the nut to the casting. The collar at the other end of the nut takes care of this pressure.

A nut bolted to the casting is shown in Fig. 160 A. This may have certain advantages when conditions of the casting are such that the boring out of a lug would be difficult. With this construction, however, one depends entirely on the resistance of the bolts against shear. It is frequently difficult to get bolts of sufficient size or in sufficient number for the fastening of such a nut because of the probable crowded condition of the mechanism.

Even without such a condition, it is unwise to have the fastening of the nut in shear. To overcome this objection, a nut is often made as shown in Fig. 161 B where it is provided with a pilot. This pilot may be round, as shown in the illustration, a tongue cast on to the nut, or even a cross key. The tongue and cross key require cross planing of the piece, which may be difficult to accomplish. It is always easy to provide a hole for a pilot. This, however, offers another practical difficulty which should be considered when a selection is made of the nature of fastening of the nut.

In Fig. 162 the nut is shown in heavy lines and the slide to be moved by that nut in light lines. The screw has its bearings in the slide whereas the nut

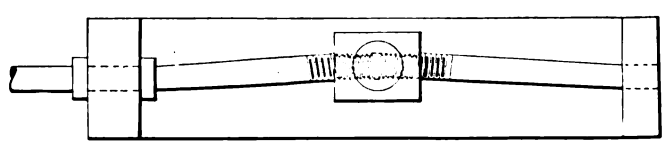


FIG. 162—EFFECT OF BORING PILOT HOLE OFF CENTER

has its pilot in the stationary piece, or vice versa. The pilot of the nut is shown off center. It is always exceedingly difficult to bore this short crosshole exactly central with the centerline of the screw. A small error of one or two thousandths of an inch might not cause much trouble when the nut is central between the two

bearings of the screw, especially if the screw is of a fair length; but if the slide has been moved so as to bring either bearing close to the nut, the screw would bind and might cause serious trouble.

On the other hand, if the construction is as shown

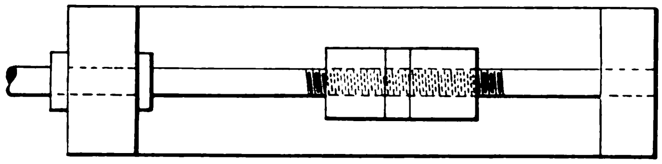


FIG. 163—LEAD SCREW NUT LOCATED BY CROSS KEY

in Fig. 163—with tongue or cross key—a small error in the direction of that key (that is, when it makes an angle of less than 90 deg. with the centerline of the hole), would also cause the same inaccuracy which we found when the pilot was off center, but this inaccuracy has the same effects whether the nut is midway between the two bearings or whether it is close to a bearing. This construction, then, is to be preferred whenever possible. There should be no great difficulty in boring the hole of the nut at right-angles to the tongue or key.

Construction of Half Nuts

Two half nuts are shown in Fig. 164, each provided with a sliding bearing. In the illustration a disk is shown behind the two nuts which can be rotated through an arc of a circle, causing the two pins, shown is dotted lines, to operate in slots in the half nuts to bring them together or move them apart. This is rather a crude construction, as it is very difficult to make all parts so that the two half nuts will bear on the screw simultaneously and in exactly the same manner; in other words, this construction is almost sure to cause one of the two half nuts only to be in action.

Another construction which is often carried out is to have a screw with right- and left-hand thread operate on the two half nuts. This screw can be made floating, that is, it has no abutment in any part except the two parts to be moved. This will insure an even bearing of both half nuts on the screw.

On the other hand, this construction also has its drawbacks. In the one shown in Fig. 164, the two half nuts can be made in one single piece, bored and

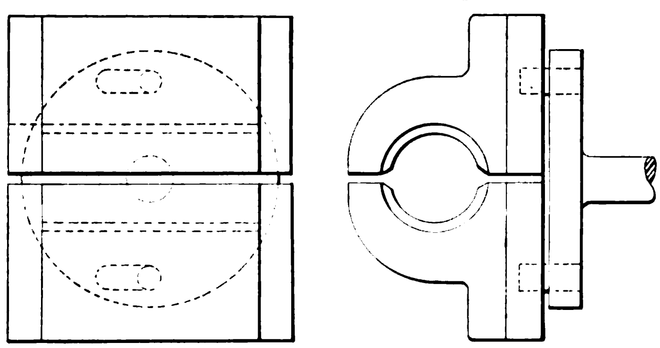


FIG. 164—CRUDE CONSTRUCTION OF HALF NUTS

threaded, and then sawed apart so that each comprises a little less than one-half of the complete nut. In the construction where a right- and left-hand screw is used for closing the nut, it is necessary either to bring the two half nuts against each other or else to provide pins or stops of some kind so that when they have gone as far as they can go, the two halves will make all or the greater part of one circle.

Introducing pins or other stops makes the fitting or assembling a rather delicate job and, on the other hand, if they are made so that they will butt against each other without such a stop, then each half nut must be the exact half of a circle so that the two parts cannot be made in one and later sawed apart. This offers no difficulties when babbitted nuts are used but requires some care if the nuts are made of some metal which has to be machined.

Nuts and screws will wear, like any other part; and many constructions have been proposed to compensate for such wear. One well-known construction is illustrated in Fig. 165 where the nut is made up of two parts, one of which can be advanced or turned through some angle and then fixed again. This, as well as practically all other suggested constructions, meets the difficulty only apparently, not really. If the wear were in the nut only, such a device might meet the problem; but wear takes place in both screw and nut.

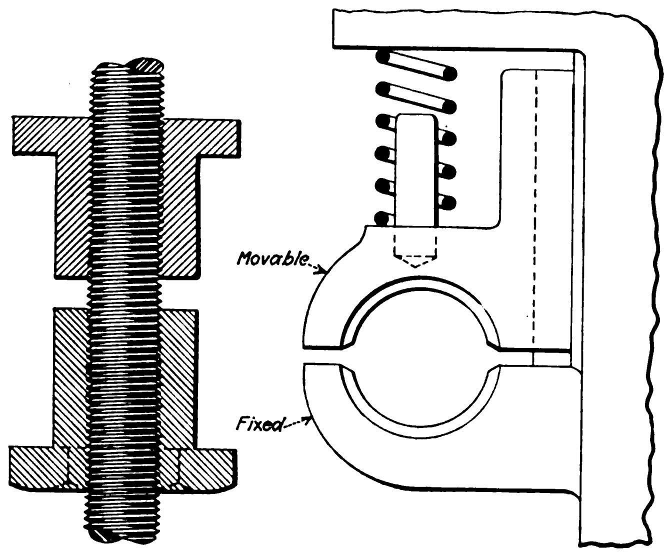


FIG. 165 FIG. 166

FIG. 165 AND 166—TAKE-UP DEVICES FOR HALF NUTS

Again, if the wear in the screw were perfectly even all over, this device might help us out of our trouble. But, in practically all machine tools, the location of a slide when doing work varies from day to day. It may well be that for a long time at a stretch only a short part of the screw has been used for feed and, of course, this part of the screw will then wear more than any other part. If the looseness in the nut is taken up and then a piece of work is placed in the machine which requires another part of the screw to be in action, this screw will be tight in the nut, and, in fact, it may be entirely impossible to use the nut under such conditions. Speaking from a practical standpoint we may say that it is useless to attempt to provide a take-up for the nut for any machine which must do a variety of work. It is, however, possible to utilize such a take-up for a special machine which always does the same kind of work and in the same position.

A take-up which can be used for light work requiring rather great accuracy is shown in Fig. 166. The angle of the thread of the screw is made so as to approach closely the friction angle between screw and nut. It is, in fact, supposed to exceed it by 1 or 2 deg. The half nut (only one-half nut is used here) is held in engagement by a spring, or a set of springs. These springs will force the nut into closer engagement when the screw thread is worn but permit the half nut to be

pushed back by the screw if it meets a part of the screw which is worn to a lesser extent. It will be seen from the construction that this device is not available where heavy work must be done.

Mention has been made in the previous paragraphs of the use of thrust collars or ball bearings in connection with feed screws. It is, of course, a simple matter to provide a take-up when thrust collars are used. A thrust ball bearing requires no adjustment for wear because when the balls or races are worn as little as two ten-thousandths of an inch the bearing should no longer be considered fit for use and should be replaced. For this reason as well as for the purpose of efficiency, ball bearings should be applied whenever possible. However, when very heavy loads are imposed on the screw, neither of these two constructions is entirely satisfactory. Under such conditions as were mentioned

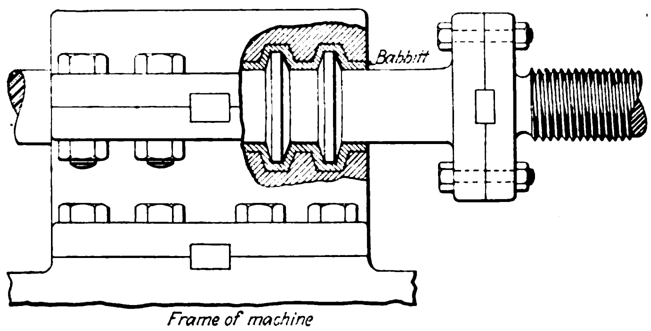


FIG. 167—MARINE TYPE HEAVY-DUTY THRUST BEARING

in the paragraph on hydraulic feeds, ball bearings become impractical although, of course, not impossible. To provide a thrust washer of sufficient area to stand a pressure of 300,000 lb. is out of the question on account of the enormous size such washers would assume. Under these conditions, then, a different kind of thrust bearing should be constructed. The so-called marine thrust bearing lends itself very well for heavy machine tools.

In Fig. 167 is shown such a bearing in diagrammatic form. An extension of the screw is provided with a number of collars integral with the body of this extension. It rests in a capped bearing which is babbitted to fit the thrust collar. A sufficient number of collars is provided to bring the pressure per square inch down to the proper amount under the conditions of lubrication. For instance, if we should be willing to allow 200 lb. per square inch, we would need 1,500 sq.in. of thrust collar surface. If the body of the screw extension should be 7 in. and we allow a height of the collar beyond this body of 2 in., each collar would have an area of practically 50 sq.in., so that thirty of these collars would have to be provided. If this is too much for the available length of such a bearing, we would simply increase the size of the body or the height of the collar. As half of the thrust must be taken up by the bearing itself and half by the cap, provision should be made so that the bolts which hold the cap to the bearing are relieved, preferably by a cross tongue and groove or by a cross key. The box itself, too, if not cast integral with the frame of the machine, should be provided with such a cross tongue or key. Pressures as high as 300,000 lb. are not ordinarily transmitted by a screw, as was mentioned before. However, the writer has been confronted with feed screws transmitting 200,000 lb. pressure and has used the marine type of heavy-duty thrust bearing successfully in such cases.

Suggestions for Improvement in Thermit Welding

The following suggestions not previously published in instruction books on thermit welding will be of interest to welders engaged in repairs to heavy sections made by this method. In previously published directions for making plastic the yellow pattern wax to be applied between sections to be joined by means of thermit welding, it was recommended that the wax should be placed in a pan and warmed until it became plastic or else melted entirely and allowed to cool until it became plastic.

Another way of making wax plastic is to pour the melted wax in a small stream into cold water. Very shortly thereafter, it can be removed with the hands and the water squeezed out. It then will be found sufficiently plastic for use.

After hollowing out a basin in the top of a rammed up mold, a channel or trough should be cut in the top surface of the mold connecting the top of the pouring gate and the top of the riser. This will cause the first slag, overflowing on top of the mold, to quickly run across to the riser and, thus while the metal is very liquid, equalize the pressure on the pouring gate and the riser.

In order to properly preheat a section in a mold without badly burning away the preheating gate, it is necessary to use vaporized liquid fuel (gasoline or kerosene) which can be blown into the mold at such a velocity that the location of the flame can be varied at will. Thus by increasing the velocity at the end of the burner pipe, the lower part of the flame can actually be cooled down and the upper part heated. The flame at all times can be so regulated that the heating gate will be dried out but will not be burned.

This is not the case with any gaseous fuel, whether it be natural gas or illuminating gas, etc., and in all such cases the flame will either start at the end of the burner pipe, or will be blown completely out. This mass of flame passing continually through the restricted heating gate during the entire preheating operation is bound to do considerable harm, and in all cases the lower part of the mold and the section being preheated will be at considerably higher temperature than the upper parts.

Too rich a flame during the early part of preheating may not be harmful, but especially toward the end care should be taken that no excess oil be used as the lean flame will tend to burn out from the molding material any oil which may have penetrated during the early part of the preheating.

Keeping Posted

By A. L. DeVinne

The principle of seniority is not always observed in shops and factories. And for this reason, if for no other, the foreman should not only keep abreast of modern practice, but keep posted as to what is being proposed and tried out. As a result, when the time comes for promotion to be considered, he will not see some "dark horse" win against him. If there is any one man about the shop who should be up to date in his line, it is the foreman. He must be a valuable source of information and counsel and he can be that only if he keeps posted.

Manufacturing Radio-Phone Head Sets

Bending and Hardening the Magnets—Molding Poles and Pole Pieces in Earpieces—Winding the Coils for Magnets and Assembling Into Complete Head Sets

By FRED H. COLVIN
Editor, *American Machinist*

WHILE detecting crystals or audion tubes are necessary to catch the vibrations of the air, and the various apparatus which has been shown before is needed to tune the instruments to these vibrations, the head set is really what translates the vibration so that we hear them as sounds. Head sets are, of course, telephone receivers, designed especially for radio work, and contain magnets, coils and diaphragms incased in insulating material.

In the set described herewith, the pole pieces are separate and held in contact with the magnet by the case which forms the body of the earpiece. The maker of this set, the William J. Murdock Co., Chelsea, Mass., is one of the early pioneers in this work, having made wireless or radio apparatus for 17 years before the present wave of enthusiasm swept over the country. Head sets are rated by their resistance in ohms and run from 2,000 to 4,000 ohms as a rule. In most cases this means the total resistance of both earpieces, while in some few cases it means the resistance of each earpiece. A resistance of 1,500 ohms for each earpiece is probably a fair average.

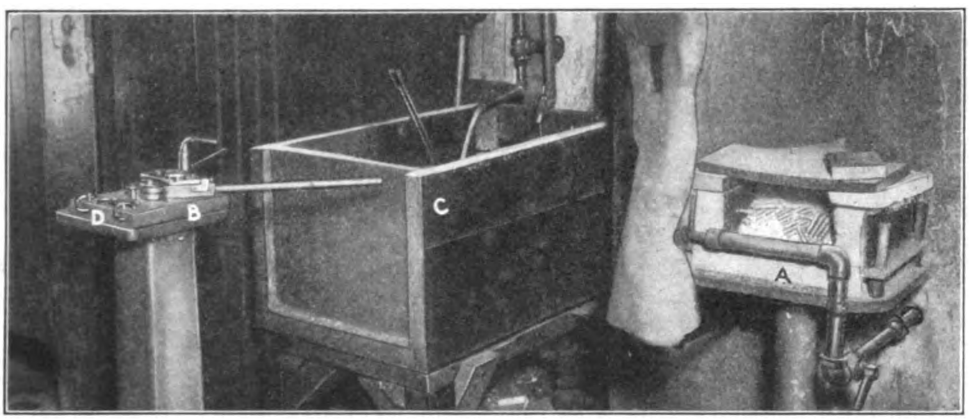


FIG. 1—BENDING AND HARDENING MAGNETS

The magnets are made from round magnet stock, which means a good steel, high enough in carbon to harden easily in water, and with a fair tungsten content. The bars are first cut off and then heated in the small gas furnace shown at *A* in Fig. 1. The heated bar is then bent to about two-thirds of a circle in the simple bending fixture shown at *B* and quenched in the tank *C* without being reheated. Two of the completed and hardened magnets are shown at *D*.

The magnets then go to the molding department where they are placed in the molds as at *A*, Fig. 2, together with the pole pieces which have been previously made from sheet steel in a simple blanking and forming operation. Two pole pieces are placed in the mold with the magnet as can be seen at *B*. These pole pieces contact with the open ends of the magnet and are held firmly in position during the molding operation.

Then a piece of insulating material, which by the way is one of the Murdock specialties as the result of years of experimenting, is placed on the mold over the magnet. The operator, through long experience, knows the amount of insulating material necessary and uses a piece about as shown at *F*. The upper part of the mold *C* is put in position, being guided by the pins *D*, and the completed mold is put in the press as at *E*. The press is of the toggle variety and forces the insulating material into the mold so as to hold the pole pieces and magnet firmly together. A space is provided for the magnet coils which are yet to go in place over the pole pieces. The mold also makes both the seat for the diaphragm and the thread by which the cap is screwed into place. It makes a particularly good thread too, which is the result of a combination of good die making and having a thoroughly suitable material as an insulator.

After a few preliminary operations the earpiece, in which the magnet and pole pieces are now firmly embedded, goes to the press, shown in Fig. 3. An earpiece body is shown in the hand of the operator and gives a better idea of the other end of the pole pieces than is obtained from Fig. 2. The ends of the pole pieces are slipped into the slots shown in the holder *A*, while the plunger *B* holds them firmly in place. The plunger is actuated by the toggle at *C*, the spring *D* being interposed to insure a uniform pressure against the block *A*. A movement of the foot now drives down the punch *E* and clips off the ends of both pole pieces to uniform length. This operation is necessary to insure the best

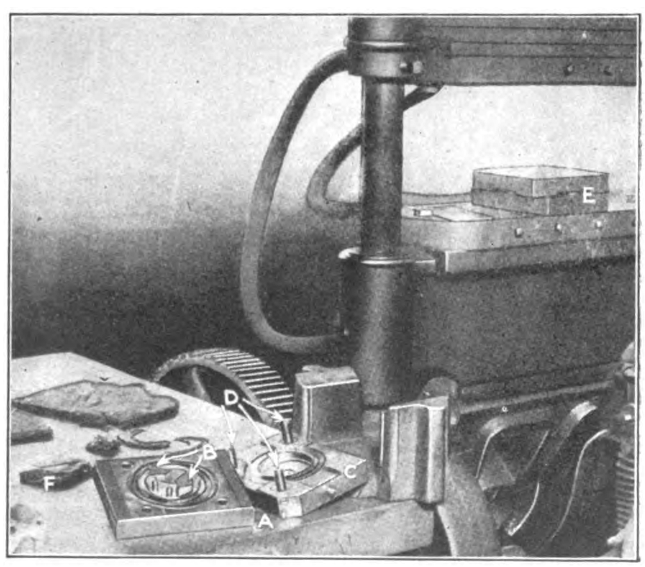
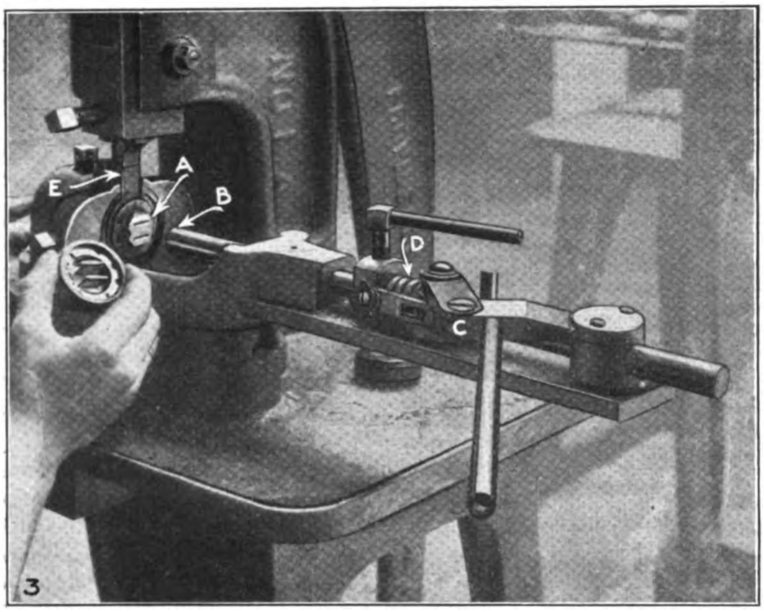


FIG. 2—MOLDING MAGNETS INTO EARPIECES



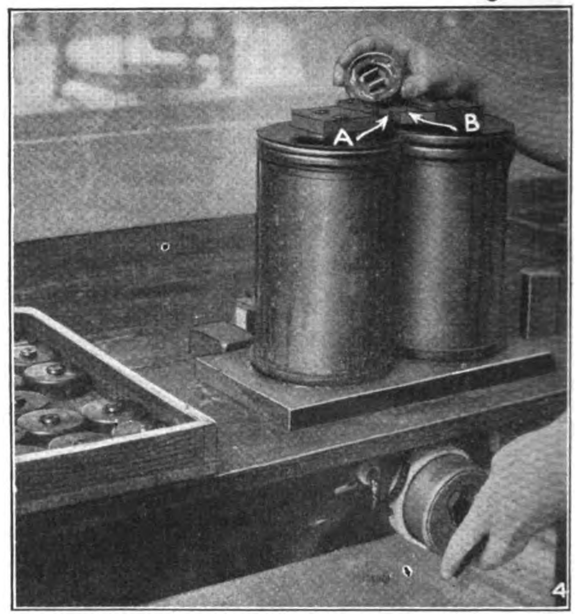


FIG. 3—TRIMMING ENDS OF POLE PIECES. FIG. 4—MAGNETIZING THE MAGNET

results and the length is carefully gaged. The important dimension is from the seat for the diaphragm to the ends of the pole pieces, the block *A* gaging it from the diaphragm seat inside the threaded rim.

The next step is to magnetize the magnet, through the pole pieces, by means of the powerful electromagnet shown in Fig. 4. Current is controlled by the switch just under the edge of the table and it only takes a momentary contact to charge the magnet. The ear piece is held so that each pole piece touches a pole piece of the electromagnet, at *A* and *B*. The magnet is then ready to receive the winding or coils.

The coils are wound on small, specially built machines, of which a battery is shown in Fig. 5. These machines have been developed and built by the Murdock company as a result of its experience in this line of work. The winding machines are run from a belt from beneath the bench, by means of a small line shaft which is motor driven. A form or hollow spool is made of two pieces of formed insulating paper as shown at *A*. Holding two of these pieces together with the raised edges outward forms them into a spool which is placed on the end of a winding spindle as at *B*. A turn of wire holds the two pieces together and the winding machine is then started by a treadle beneath the bench.

The wire is insulated by a coating of black enamel which is so thoroughly put on as not to crack in the bending and winding operations. This wire comes on spools which are mounted in frames as at *C*. The winding machine contains a counter (driven by a worm from the spindle and carrying a star wheel *D*) from which the count is easily taken. Two completed coils are shown at *E* and a box cover is fairly well filled with them at *F*. An earpiece with the two coils in place is also shown in front of the box cover.

The coils are then made up into pairs, the connecting ends of the wires soldered together, and the pair mounted over the pole pieces as in Fig. 6. The other ends of the wires are fastened to the terminals by which the coils are connected to the cords that plug in to the detecting and tuning apparatus. Electric soldering irons are used, owing to their great convenience for work of this kind.

Some idea of the extent of this business, due to the unprecedented demand for apparatus to "listen in" on the broadcasting stations all over the country, may be

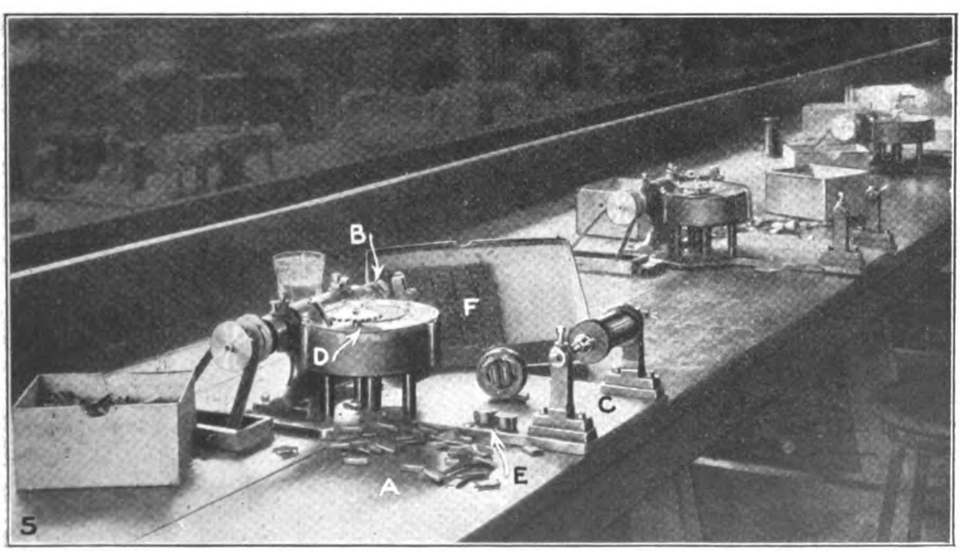


FIG. 5—WINDING THE MAGNET COILS. FIG. 6—PUTTING THE COILS IN PLACE

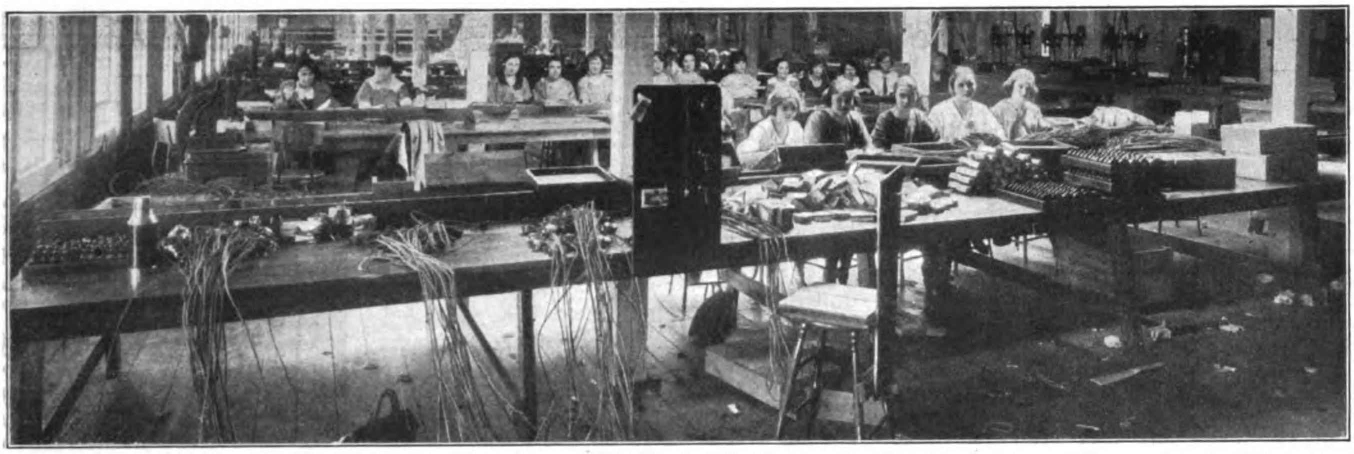


FIG. 7—ASSEMBLING THE HEADPIECES

had from Fig. 7, which is part of the assembling room for the completed head sets. This room is in the second story of a former electric railway repair shop and has only recently been taken over by the Murdock company in its endeavor to supply the demand for its instruments. This view shows the trays of head pieces, the assembling of the headpieces, the assembling of the flexible wires or "cords" which connect them to the receiving apparatus, and all but the head frames which hold the ear pieces in a fork and keep them in position over the ears of the listener. Even though this building is old, the lighting is remarkably good, the side windows having been supplemented by several skylights of liberal dimensions.

Leaving the headpieces we find an interesting die casting job in the making of the variable condenser used in "tuning" by some makers of receiving apparatus. The condensers consist of two series of thin metal plates, evenly spaced and so mounted that one set of plates can be swung between the other for any desiderd portion of their surfaces. There are two kinds of plates as shown at *A* and *B*, Fig. 8. The required number of *A* plates are assembled in a suitable mold or

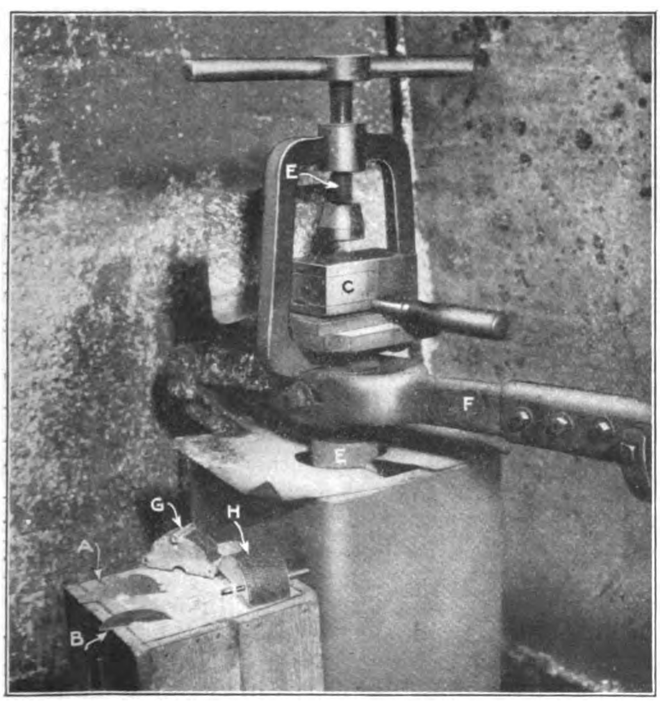


FIG. 8—DIE-CASTING CONDENSER PLATES

fixture which spaces them the right distance apart and the mold is placed in the die-casting machine as shown at *C* and held in position by the screw *D*.

Below the frame is a pot of molten lead or type metal into which the plunger *E* reaches through a suitable opening. With the mold clamped in position over the opening in the table above the plunger, the lever *F* is brought down, forcing the metal up into the mold and casting it in position around the plates. Two completed sets of condenser plates are shown at *G* and *H*, the plates in *G* being held in three places and the ones in *H* only in the center. In use, the plates *G* are held stationary in the apparatus by three bolts while those at *H* are swung by means of the shaft shown so that they pass between the others. The method described is a simple and effective way of assembling the condenser plates and one that is proving very satisfactory.

Strikes and Walkouts

By R. Grimshaw

The chances are about ten to one that every factory will be visited some time or another with the strike fever. The visitation will be less likely, however, if the employees are educated to a few hard facts from labor sources. For instance, that (according to A. F. of L. figures) in 1919 there must have been collected in dues, $39,120,816, of which only $6,705,287 or about 17 per cent was paid out for union benefits (sickness, death, etc.), and only $1,391,833 or say 3.5 per cent for cost of strikes, leaving $31,623,696 or 79.5 per cent, for expenses of the unions.

It might also interest them to figure up how long it takes to make up from increased wages, even when a strike is successful, for the time when they were receiving from strike benefits only 3.5 per cent of their own money paid in as dues.

Put concretely, suppose men getting $50 a week strike for 10 per cent advance, and get it after two weeks' idleness. They lose $100 which divided by $5 gives 20 weeks before they are financially whole again. If they are out 10 weeks they lose $500 in wages, and it takes two years before the extra pay makes that up. In the meantime, instead of using all their savings to live on, they are getting only 3.5 per cent of what they had paid in, and this, no matter whether these $50 hands get $10 a week or $20 strike benefits. For every dollar that the average worker contributes to the unions, he gets back only 17 cents as sick benefits and 3.5 cents as strike pay.

Credit in the Machine Business

By H. B. Egg

It is important to know when credit should be asked for and when given, and for what purposes. In buying the daily commodities, you ordinarily exchange cash, which represents labor or other value, for something which represents labor and materials. There is no reason why the seller should wait for his money.

If you buy several objects every week or month from the same seller, the deliveries may occur at various times when it is not convenient to pay, and you can make arrangements to pay what you owe once a month, provided the seller has confidence in your willingness and ability. There is no law requiring that you be allowed thirty days, but you are given this time simply for convenience. If you want credit because you do not have the money today, you may likewise not have it thirty days hence.

Special Payment Methods

Special methods of payment are needed for articles made to order, because if the buyer fails, dies, or changes his mind before paying for the work done, the seller would suffer loss through inability to dispose of the special material. On all material made to order, including machinery, it is customary to make partial payment with the order, and often weekly or monthly payments thereafter.

Ignorance of the true uses and purposes of credit causes many young concerns to apply for credit on every purchase they make. Quite often they get it from merchants and manufacturers who ought to know better. Debts should not be incurred for the purchase of initial equipment, as a rule, because if the finances are that weak, there may not be enough cash to meet payrolls and current expenses. Sometimes it is permissible for new concerns to start under the handicap of a mortgage, but usually it is better not to. Lack of cash induces the temptation to pay thirty-day accounts in sixty or ninety days, and the business goes behind generally. Payments must be made eventually, and if they cannot be made when due, there is no especial reason why cash will be forthcoming in the hazy future, unless the firm is un-businesslike enough to permit its customers to take their own time in paying bills. If that is the case, then there is much trouble and anxiety in store.

Always Prompt Payers

If a new business is started off with enough cash to buy equipment, meet a few payrolls and other expenses, the men in charge should realize that there are plenty of prompt payers in the market without bothering with the slow or un-businesslike ones. Orders should be taken from the good payers; then it is simply a matter of keeping expenses below income to keep the business off the rocks. Competition is one of the most trifling worries in the machine business and causes a very small percentage of failures. On the other hand, slow collections and bad debts cause financial weakness.

It sometimes happens that special credit arrangements are desirable. For example, the company which employs the writer needed several machine tools to put through a large order. The business was small and lacked the necessary cash. We had never borrowed from the bank and did not know how to do it. (The machine industry is full of people just like that.) After a talk with the machine-tool builder, he found our business references and reputation satisfactory, and let us have the machines, to be paid for in six months, in six installments, without interest. His business was dull, or he might have charged us six per cent or have advised us to borrow from the bank. Long-time payments under such conditions, where everything is agreed upon in advance between both parties to the sale, are quite proper, and will not give a concern a bad name.

The size of a company has no bearing on its credit rating. Some of the smallest companies are "excellent pay," while some of the large ones are very slow and unsatisfactory. The way to build up a good credit reputation is to agree upon the terms of payment before the purchase is made, and then pay on time.

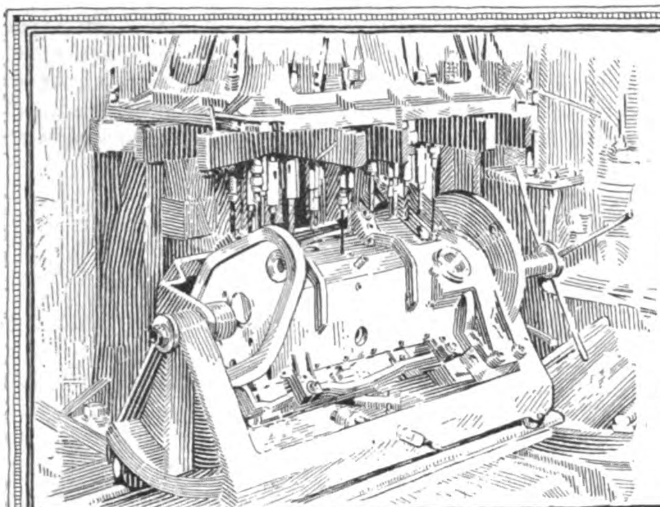
Many concerns will make purchases which should be paid for by cash upon delivery, but will ask for thirty days, knowing that they will need ninety days. The other day we received an order for some special turned and threaded shafting from a new customer. Our credit man asked for cash in advance. The customer informed him in a sarcastic manner that only one-horse concerns did business that way, and stated that they would pay in thirty days. On making inquiries from five supply houses which supplied this customer, we learned that he was very slow pay, running sixty to ninety days behind. We compromised by taking one-half cash with the order, and the balance on delivery of the material. When a customer asks for credit on a special material order, and has no account on your books, just keep the fact in mind that the payroll cannot wait thirty days or so.

Pick Customers

One time our company found itself in a peculiar condition, with all current bills paid, practically no cash in the bank, and a payroll to meet. Several thousands of dollars were owed to us on accounts. The business was over twenty-five years old, and a bank loan ought not to have been necessary. An investigation showed that about forty-five customers were in the habit of paying us when they got good and ready. Almost seven hundred others paid promptly. The few slow ones would not want it thought that they were dishonest or unbusinesslike, yet they forced us to pay the bank six per cent on money that they ought to have paid us. Of course we were at fault in allowing them to be so slow, but we were afraid that too strict an attitude would lose us trade. Then we learned that it is better to lose the order than to lose the money. An order can be gotten from some other customer, but when the money is lost, it is gone.

A new credit policy was adopted, as follows: Material made to order for customers who do not have monthly accounts, cash in advance. Sales from stock to customers who do not have monthly accounts, cash on delivery. Current sales to firms with high credit rating, thirty days net, where at least one purchase is made per month. Casual sales to firms out of the trade, cash on delivery. Any sale to customers who do not respect our thirty day terms, cash with order.

Since instituting this method, we have had very few complaints about cash payments, and the most strenuous objectors were almost without fail the ones with the worst business reputations.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Details of Design of Blanking Dies Continued — Standardization of Parts of Dies— Design of Guide Pins—Methods of Holding Punches

IT SEEMS desirable to bring up here the matter of standardization in dies, and point out its importance so that the designer will realize its utility and advantages. There are certain parts in all dies which remain the same and can be standardized. For example, the die shoe, die blank, stripper plate, punch plate, punch holder, liner pins and bushings. If these parts are designed correctly, a great many machining operations can be performed before the die opening is cut out of the blank. By using proper tools and gages these standardized parts can be produced in quantities on an interchangeable basis at much less cost than by machining one or two at a time when required. In addition to these points a new die can be made from standard parts in much less time than if the entire die must be made for each particular job.

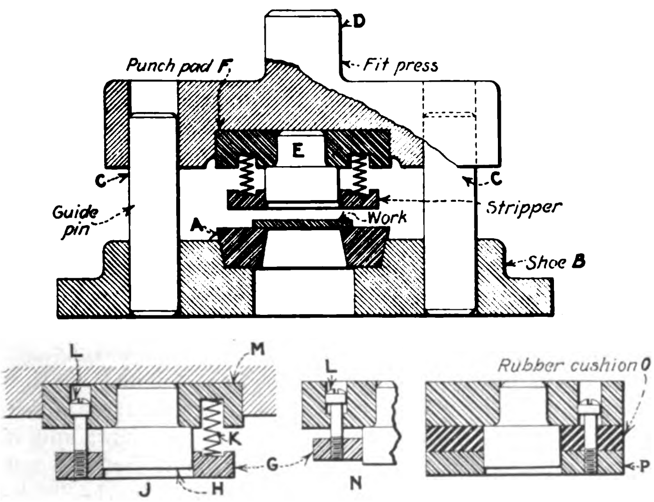
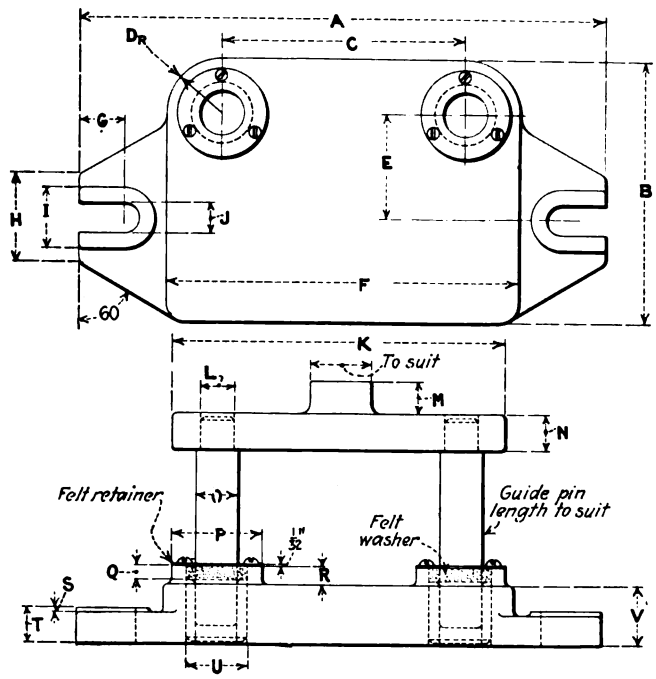


FIG. 456—DIE FOR LARGE BLANKING, SHOWING GUIDE PINS AND STRIPPER DESIGNS

Naturally, any company using punch presses covering a wide range would need to standardize their various units in accordance with the sizes of work to be produced and the presses used. The importance of this standardization cannot be over-emphasized, and its advantages are apparent to even a casual observer. A great many companies who use large quantities of dies yearly have found the process of standardization of the greatest value.

Blanking dies are frequently made with guide pins, as shown in Fig. 456. This particular design is generally used for heavy work. The die shown at *A* may be set into the shoe *B* in different ways, according to the shape of the work which is to be produced. In work of a circular form a recess can be cut in the shoe and the die forced into it, being suitably held by screws. There may be a slight taper on the sides of the die to insure concentricity, if desired. If the work is long



Shoe No.→	1	2	3	4
A	10	11	12¼	14
B	5	5½	7	10
C	4	5	6	7
D	1¼	1 5/16	1½	1½

FIG. 457—STANDARDIZED DIE SHOES AND GUIDE PINS

or irregular in shape a slot can be cut in the shoe and the die fitted into it. In this type of die the guide pins shown at *C* align the punch and die so that they register correctly. The stem *D* fits the punch holder of the press.

It will be seen that the stripper used on this type of die is different from those which have been previously described. The punch *E* is mounted in a punch pad *F*, and the stripper remains with the punch instead of with the die. In the section shown at *J* the construction is clearly indicated. The stripper *G* is a sliding fit on the punch *H* and is forced downward by means of springs *K*. The movement is limited by the heads of the screws shown at *L*, which screws seat in the punch pad *M*. The diagram at *N* shows the position of the stripper *G* after the punch has entered the work, and it will be seen that the retaining screw *L* has moved upward in its pocket at this stage of the process.

A rubber cushion such as that shown at *O* is occasionally used in place of springs to act on the stripper *P*, but this is not generally as satisfactory as springs, although for certain classes of work the rubber cushion is used considerably. The disadvantage of it is that the rubber soon loses its elasticity under the constant pounding, so that the action of the stripper is not thoroughly efficient unless the rubber is frequently renewed.

When a die having guide pins is used it will be found profitable to standardize the sizes. Fig. 457 gives an excellent example of a method which can be used for standardizing such parts. In this case there are four die shoes, the general dimensions of which can be shown in a table placed on the drawing sheet. Additional dimensions can be given for various other parts of the die, but it has not been considered advisable to give them in the table shown at the bottom of the illustration. They can be varied according to the practice of different manufacturers. This type of die shoe and punch holder has been used considerably by the writers and has proven to be of excellent design. The guide pins in this case are fastened to the punch holder, details of which are illustrated in Fig. 458. There may be cases when it will be found necessary to change the location of the U-lugs, but the general design would not be affected, even if this were found advisable. The

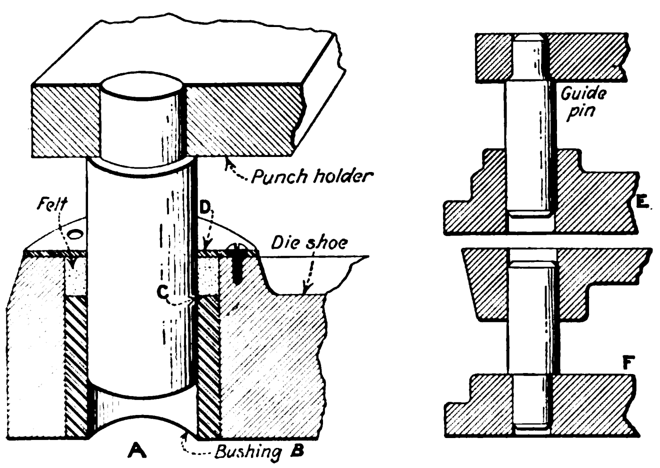


FIG. 458—GUIDE PIN DETAILS

length of the guide pins would be made to suit conditions.

Details of a guide pin, die shoe and punch holder are shown in Fig. 458. In the example at *A* the guide pin is fitted to the punch holder, and if necessary can be held in position by a setscrew or a dowel pin. The die shoe is provided with a hardened steel liner bushing *B* which has a radius at *C*. On the upper part of the bushing a felt washer is placed and is held in position by the steel washer *D*. The felt is saturated with

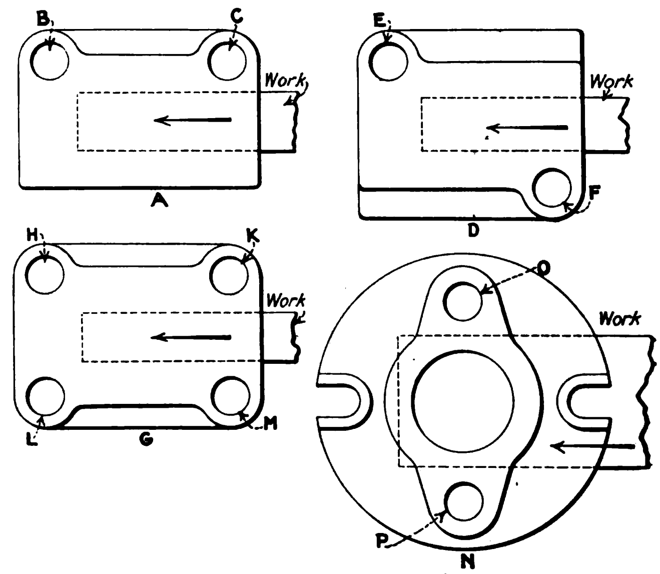


FIG. 459—STYLES OF DIE SHOES, SHOWING POSITION OF GUIDE PINS

oil, so that as the pin works up and down in the bushing it is always properly lubricated.

The use of bushings in die shoes is not always necessary, although the life and accuracy are greatly prolonged by their use. In high production work, bushings are recommended; but if the product being manufactured is produced in only small quantities the extra expenditure is not warranted, and the guide pins can be made to bear directly in the cast-iron shoes. Spiral or straight oil grooves should be cut in the guide pin to retain the oil and assist in lubrication. These oil grooves should not be deep, as their function is simply to gather and distribute the oil through the bushing, an important function, nevertheless.

The position of guide pins has been a source of argument among designers; and some believe that it is better to place the pins in the punch holder, while others contend that it is better to place them in the die shoe. The examples at *E* and *F* illustrate these two methods, but as both are often used successfully we express no preference for either type. The function of the pin in either case is to provide an accurate guide so that the punch and die will register properly; and if proper provision is made so that chips and dirt will not tend to accumulate around the punch and in the bushing, there should be no difficulty experienced with either method.

There are a number of ways of arranging guide pins and several of the methods are shown in Fig. 459. In the example *A* two pins *B* and *C* are used at the rear of the die shoe. The direction which the work takes when passing through the die is indicated by the arrow. In the example shown at *D* there are two guide pins *E* and *F*, one at the front and one at the rear of the die shoe. The work passes between the pins as indicated. A die shoe is shown at *G* having four pins *H*, *K*, *L* and *M*, two of which are at the front and the other two at the rear of the die. Another example, shown at *N*, is quite different from those previously indicated. The

pins *O* and *P* are on opposite sides of the die and central with it. The die shoe itself is circular in form.

The example at *A* is considered best for medium sized work, as the front of the die is entirely open and it is therefore somewhat more convenient of operation.

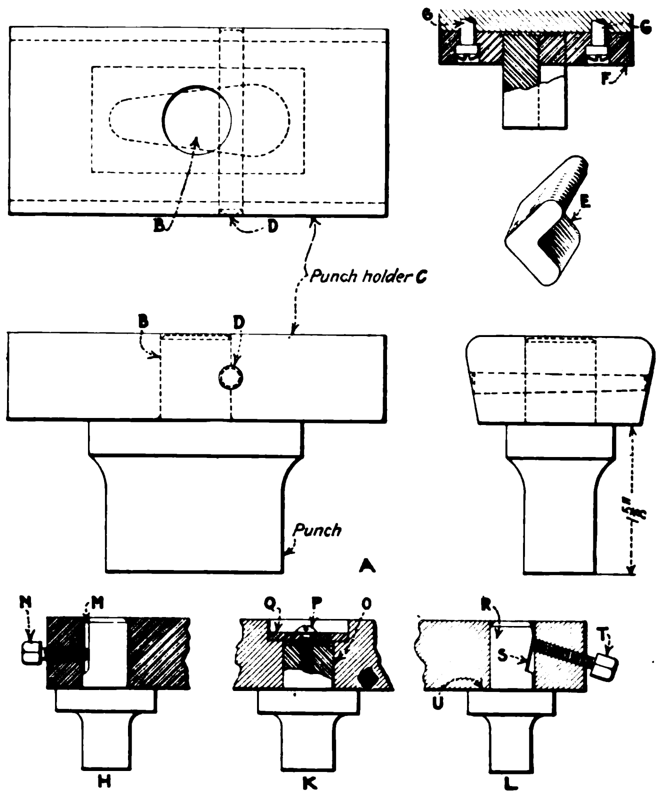


FIG. 460—METHODS OF HOLDING PUNCHES

The stock is more easily fed through and the pins are not in the way. The other styles are used from time to time, depending upon the class of work which is to be done and the size of the die.

Punch Holders

In a previous article we mentioned several general points in connection with punch holders, and we shall now take up some of the detailed matters connected with the design. Fig. 460 illustrates in detail several methods of holding punches in punch holders. In the example *A* the punch is fitted with a shank *B* which fits the punch holder *C*. As the shape of the punch is irregular, a tapered dowel pin D is used to hold it in position, and the punch drawn up against the under side of the punch holder and held in place firmly. The shape of the punch is clearly indicated by the dotted lines in the upper view.

It may be well to state here that punches for stock from $\frac{1}{16}$ in. to $\frac{3}{16}$ in. thick should not be less than $1\frac{5}{8}$ in. deep, as indicated in the diagram. When the work to be punched is thicker than $\frac{3}{16}$ in., the height should be correspondingly increased. For work less than $\frac{1}{16}$ in. thick, the depth of the punch can be decreased considerably according to the thickness of the stock. The purpose of using a long punch is to prolong the life of the tool and allow regrinding as it becomes dull.

Another irregular punch is shown in detail at *E*, and the method of fastening it is by using a holder *F* into which the punch is fitted as shown. This supplementary holder is screwed and doweled to the punch holder by screws shown at *G*. The upper end of the punch is left soft and the supplementary holder *F* is countersunk slightly, so that the punch can be peened over into the recess, thus holding it firmly.

In the diagram at *H*, *K* and *L* several other methods of holding punches are shown. In the example *H* a flat is machined on one side of the punch at *M*, and a plain setscrew *N* is used to hold it in position. In the example *K* the shank is turned cylindrical at *O* and tapped to receive the screw *P;* the washer *Q* acts as a retainer and prevents the punch from falling out. If this method is used for cylindrical punches no other provision is necessary, but if the punch is irregular a locating pin or dowel may be required. In the example *L* the shank *R* is milled away at one side, as shown at *S;* and the set-screw *T*, being placed at an angle, holds the punch in position and at the same time draws it up against the face *U*.

In Fig. 461 are shown several other methods which can be employed for holding punches. In the example *A* the punch *B* is quite similar to one which has been shown in the preceding illustration, except that it is considerably larger so that it requires a slightly different method of holding. It would be possible to slot the holder and make a corresponding tongue on the punch, as this would give a very excellent method of aligning. This example, however, is located on the face of the punch *C* by means of the dowels at *D* and *E* and it is held in place by the four screws at *F*, *G*, *H* and *K*. This gives a very substantial method of construction, and the punch is located with the necessary accuracy.

In another example, shown at *L*, the punch is of the form indicated so that it must be located accurately in relation to the die, yet its general shape makes it desirable to use a shank of cylindrical form as shown at *M*. In a case of this sort the location can be obtained by leaving the shank soft and placing a pin so that it acts as a key, as indicated at *N*. The same result can also be obtained by using a regular key, as at *O*.

In the example *P* a wire punch is shown that is sup-

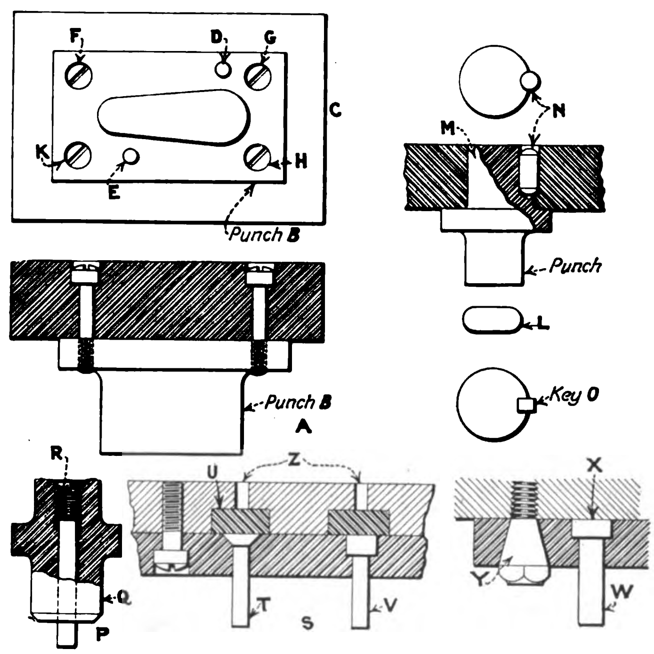


FIG. 461—OTHER METHODS OF HOLDING PUNCHES

ported in a holder *Q* into which it is driven. It is backed up by means of the adjusting screw *R*, which permits a certain amount of variation in the setting. This method is not recommended, except in cases where the thickness of the blank is less than $\frac{1}{32}$ in. Another

method of holding two wire punches is shown at *S*. The punch *T* has a tapered head, and it is backed up by a steel disk shown at *U*. The other punch *V* is similar, except that the head is of larger diameter and straight instead of angular. It is backed up by a steel disk in the same manner as the first. A knock-out hole is provided at *Z* in each case.

The punch *W* is of similar form to that shown at *V*, but it is not backed up at all and comes against the cast-iron punch holder at *X*. The wear on the cast-iron holder will be so great that after the punch has been in use a short time it will lose its position and form a pocket in the punch holder, thus causing looseness and preventing accurate work. A condition of this kind might very easily result in breakage. The method of holding the punch holder is by means of a tapered screw *Y*, the taper acting as a dowel and the screw portion holding it in position.

How Stock Shortages May Be Eliminated

By R. C. Gifford
Superintendent of Production, Automatic Electric Company

High inventories and shortage of parts in assembly departments, with the resultant inefficiency, are difficulties which daily face the average factory manager. The more complicated the product, the greater the problem presented. A solution to the problem, however, has been found in the Chicago factory of the Automatic Electric Co., where 25,000 different parts are manufactured and 10,000 different raw materials used. Production meetings, which were formerly nightmares, have become a pleasure. No longer do the long list of stock shortages and the longer list of alibis take up the entire time of the meetings.

Some years ago, Henry Ford put an automobile on the market at a price that was thought to be lower than manufacturing cost. No one gave it much attention except to watch for the smash. Soon the price was lowered and manufacturers began to take notice. Another cut was made and they began to investigate. How was it done? Mr. Ford had standardized parts and also had attained large production. This standardization helped, but what was the most revolutionary of all his methods, he had mixed machine and assembling operations without discrimination. "Very well," said the wise manufacturer, "He can do that, but it would not work in our business. Besides, grandfather didn't do it that way."

When every other scheme we could think of failed to "kill the shorts," we thought of Mr. Ford. If he could mix machine operations and assembly benches, why not we? A careful study, however, revealed the fact that the chief offenders were not the standard parts used day after day, but were the specials used in varying quantities and intermittently.

It had been our plan in the past, as with most manufacturers, to group like operations together in one department. Thus, all punch press work was in a single group, all drilling in another, coil winding in a third, spring assemblies in a fourth, and so on. In this method, there is one and I may safely say, only one advantage. A minimum amount of expert supervision is required, and this benefit, in most cases has been allowed to overshadow the many disadvantages. The cost of the extra trucking and handling of parts from department to department often amounts to many times the saving in supervision. But most expensive of all losses is that due to delays in the assembly departments from a shortage of stock.

In desperation, rather than with any well defined assurance of success, we decided to experiment with Mr. Ford's scheme. Spool frames used in making magnet coils were chosen for the trial. The assembly work was done on small punch presses. A half-dozen such presses were installed in the coil winding department, and one of the diesetters was placed in charge under the coil winding foreman while the planning of the order of work was placed in the hands of the dispatcher who also planned the coil winding. From the day these presses started running, the shortage of spool frames ceased. Not only were the delays of the coil winding operators eliminated, but the inventory of spool frames was reduced over 50 per cent. This experiment was so successful that other punch press operations on parts used in this department were transferred with similar success.

An interesting case in connection with this transfer had to do with a very simple operation. A small U-shaped piece made from sheet brass was used in large and regular quantities of about 25,000 per day. This part appeared on the short list regularly about once a month. Investigation revealed that the punch and die for this work required repair at monthly intervals, and that the delay in repairing was sufficient to cause too long a break in production.

A duplicate and even a third set of tools did not stop the shortage of this part, but the reason for this was easily understood. The toolroom force was always busy and knew that one set of tools was being used, and so it let the repairs wait until all three sets were sent down. This operation was moved to the punch presses in the assembly department and the shortages ceased.

After several months, this part again appeared on the short-list at two meetings in succession. I made a quiet investigation to see if I could locate the cause of the trouble, since it seemed that our much talked of system was falling down. I found that without notice the job had been transferred back to the main press department a month before. It was again moved to the assembly department and the production meeting has not heard it mentioned since that time, over four years ago.

At first thought, there would seem to be no reason except gross mismanagement or negligence for the persistence of a case such as just outlined. In fact, I fought this problem for years with that idea in mind, continually raising the grade of employees until only technical college graduates were employed. Still the solution was not reached. But the answer now appears simple. The dispatcher or foreman, using the parts in question, knows their relative importance to his assembly department, and when the stock gets dangerously low he is in a position to bring the necessary pressure to bear to start the stock moving. On the other hand, if this same work was done by a department other than the one using it, the pressure was quite as likely to be exerted upon a part the stock for which was not so nearly exhausted, while the more important part was neglected.

Later it became necessary to enlarge the plant capacity and to rearrange all departments. The scheme here outlined was made the standard in the new layout, even where available floor space required placing the same class of assembled units in more than one department. However, two years of operation have proved it to be entirely successful.

President's Address to National Machine Tool Builders' Association

Machine Tool Builders at Fall Meeting Hear Statement of Problems Facing the Industry Evils of Price Cutting—Value of Accurate Cost Accounting

By August H. Tuechter

On June 12, 1902, the National Machine Tool Builders' Association was organized by 17 lathe builders. The first annual convention was held on Oct. 14, 1902, so that this convention marks the completion of our twentieth year as an organization. Of the 17 charter members only three have voluntarily resigned membership while continuing business. Three others have retired from the business and four gave up their membership through consolidations in which they have merged. This seems to me very good evidence that this Association must have meant something in all these years to those charter members who started it and who have stayed with it ever since.

Speaking for myself and my company I know that the Association has meant much to us since the day we joined it, that each year it has meant more than the year before, and as I vision the possibilities of associated effort, in each coming year this Association can and should mean increasingly more than any preceding year. You are all convinced of the cumulative value of advertising in building up the good-will factor of your businesses. I think the same cumulative value exists in associated effort.

Proper Competition

I look back to the days of cut-throat competition that existed prior to the formation of this Association, and I think of how much better things are today. All cut-throating, all unethical competition has not been removed by any means, for the strain of the last two years has revived some bad practices that we must seriously set about stamping out. But even though we have been going through, and are only just emerging from the worst slump the industry ever had, I am encouraged by noting how much rarer we have found these bad practices than they ever were before in less severe depressions.

Twenty years ago a printed price list was only the salesman's top limit in the vast majority of cases. Today this is true in very few cases indeed. That is itself a tremendous advance, but we still must work to eliminate the abuse of discriminating prices in the few cases where it still exists or where a backslide took place in ethics. Deviations from one's published price list are essentially unfair, and besides they hurt the very man who makes them. If you are quoted a confidential 5 per cent off a price list, you can never be certain that your competitor is not quoted a more confidential 10 per cent off. Any buyer buys with more confidence and respect from a seller whose price list means exactly what it says. Besides, this single price policy creates a good will and respect among competitors that is sure to improve competition.

The whole automobile industry works on a basis of openly published prices and there is no reason why ours should not. Nothing leads to reprisal and cut-throating as much as giving secret discounts and rebates; nothing gives the unscrupulous buyer a strangle hold on sellers, like the knowledge that an industry is shot through with such practices. On the other hand, nothing makes more for fair, honest, manly competition than openly announced prices that are not deviated from until replaced by other openly published prices.

An artist painting pictures not only gets his living from his efforts but he puts his heart in the work he is doing. The joy of accomplishment spurs him on. So with a constructive business man; his business is an art, and its successes satisfy his instinct of achievement, as well as furnish a means of livelihood. Just as musicians, painters, and sculptors in foregathering to discuss their art find their strongest friendships among their fellow craftsmen, it is equally true with business men.

Attitude Toward Competitors

I count it of just as much value to gain and hold the respect, the esteem, the friendship of my competitors as of my customers. Perhaps it is more valuable, because contact with a single customer is only occasional, while our competitors we have always with us. A single customer is met only "where is," but a competitor is met everywhere. The bad opinion of a single customer affects us adversely only in proportion to the size of his individual trade, but the bad opinion of a competitor hurts us everywhere.

Trade abuses are parasites that sap business of the life blood of profit. Abuses are rooted in envy and grow in hate of competitors. Only where the competitive soil is soured by suspicion can abuses take root and grow. Sweeten the soil by confidence and these noxious abuses wither and die, and the life blood of profit runs full and free. A healthy business is rooted in emulation, not envy, and it grows in respect and friendship of competitors, not in hate.

Is Friendly Co-operation Worth While?

How do we make friends? Only by being fair-minded, by being open and above-board in every way. Meet your competitor at least half way. Don't lie, don't cheat, don't slander his character or his product. Go out of your way to "do unto him as you would have him do unto you." Be generous with information. Cast your one bit of information on the waters and it will return to you a hundred fold, for a hundred others are doing the same with their bits of information. Enrich the soil of competition with respect for yourself, with friendship and fair play for your competitors, and you will reap a bountiful harvest.

An association can be worth while to its members only as the members put co-operation into it as well as dues. Not always have those who pay the highest dues contributed the most valuable ideas and suggestions. The Association's "Activities Chart" shows the variety of ways in which co-operation has benefited different members during the last two years. The bulletins sent out have covered a wide variety of information.

Without a central depository into which each member drops suggestions now and then, how could all this information be gathered and be made to benefit you by its variety and its careful competent presentation? Not a single bulletin has gone out but what some member or other commented on its helpfulness to him in solving some problem or in presenting some idea that had not occurred to him before.

Without an Association how could we eliminate illegitimate practices? On a single sale men have lost more than their year's dues because they took the word of a lying buyer as to a competitor's business methods. How could we strongly present the interests of the industry in matters of legislation? How could we do all the other things that modern business conditions force every industry to do by organized co-operation?

Is Our Association Practical?

Some members have resigned saying that the Association costs too much. Whether non-members realize it or not, this Association is working for their interest as well as the interest of its members, and from that aspect it is unfair for them to have the members carry the non-members' share of the industry's load as well as their own. Of course we cannot expect all men to be farsighted and realize the necessity of this work, so it remains for those who do realize its necessity to support this work and carry the "White Man's Burden." Only by education and demonstration can we hope to convert the others and get them to join with us in the work we must do for them as well as for ourselves.

Some, members and non-members, may think that the things we are proposing to do are day dreams, but I can assure you that our General Manager has not yet proposed any activity that he could not show to be in successful operation in some other association. Other industries have had more active associations than ours for many years. Our General Manager has kept in touch with as many of these as possible. He does not lack knowledge of what is worth while, nor ability to carry out any good activities that any other association has. He can and will make our Association as effective in every way as any other association. But he cannot go far if the membership do not co-operate and do not use the facilities of the Association.

The Association as a Constructive Influence

Essentially, every association is simply an information bureau. Nothing can be forced on members. They can merely be shown the facts and be asked to consider these facts in the management of their own business. When it comes to mopping up information our General Manager is a human sponge with unlimited capacity. But while he is soaking up all this information from all sorts of sources, all our members do not reach out their hands to squeeze the sponge and draw the information out of him. Those who do that know that it pays well.

Knowing what we have done and can do, I find it strange that some members do not use the Association to the fullest extent that they really can and should.

I take this occasion to record the progress to date of the broader activities that were begun at the time I entered upon the presidency. First there was the engagement of Scovell, Wellington & Co. to lay out the general principles to which the cost systems of our members should be brought to conform. This work was well done, and we have had many favorable comments on it. But unfortunately, the severity of the depression prevented us from getting much further than presentation and discussion of the report at a series of regional conferences and at the Cleveland Convention in February, 1921.

If we are now to have more active business our members should seriously set about getting their cost systems in line with the principles accepted, so that they will be better informed than they have ever been, when making prices. Only by so doing can you be sure to bring out the costs of idleness. These go on whether you directly set them forth or not. Only when you do know those idleness costs as they are can you determine which are unnecessary losses, and which are necessary costs of your business. When you actually have those costs of necessary idleness staring you out of countenance you will insist on getting a fair price for your product, one that will return those costs to you.

Unless these costs are recouped in price, this industry will stay on a low plane of remuneration unfair for all its participants, from apprentice boys up to presidents. Prices in the past have been based too much on mere hazy opinions of costs. There has been a general feeling that somehow or other we don't get out of our efforts the same reward that similar efforts bring to our neighbors and friends in other industries. If this is true, and I believe it is, it is because we have never had the facts of real costs so clearly before us as to permit of no dispute.

The Problem of Necessary Cost of Idleness

Facts are stubborn things, and convictions backed up by facts are a lot safer than hazy impressions as to costs. If you and your competitor both make unprofitable prices due to that sort of error in costs, you hurt the whole industry, and you owe it to yourselves to use better methods. Other industries find it profitable to spend much money and time on cost work, and our Association from now on should aim to do likewise. It is an investment, not an expense.

We are apt to think that the excess capacity in our industry, which has loomed so large and so idle during the last two years, is wholly a result of the war activity, but this is only partly true. The machine tool industry has always needed a maximum capacity considerably in excess of its average demand, taken over a period of years.

This is because our industry naturally suffers from what the electrical engineers term a "bad load factor" in electric light plants where a high peak load makes a large plant necessary, though the average load is low. The electrical people have given this load factor serious attention, and the peak load consumers pay rates in proportion to the expense of carrying idle equipment.

It appears to me that we could well give the same kind of consideration to the financial effect of our load factor on our pocketbooks. False bases for costs make false bases for prices. Too many of our industry use that method of dividing the total amount of expense incurred for a given period of the productive hours for that period, and calling the quotient their burden. This method has been sarcastically and truly described as a method of wasting money to give clerks simple exercise in long division to conceal costs.

Basing prices on such figures in boom times simply blinds one's eyes to the necessary cost of idleness in this industry, and leaves that cost out of the price of the product. It prevents the accumulation of a neces-

sary reserve to carry over the succeeding depression. It gives a false impression of profits during the peak load period; that makes stockholders hungry for fat dividends just when the cash should be kept in the business, and later on makes the stockholders blame the managers for weakness when receiverships occur.

That false method deludes managers in desperation during depression to sneak up back alleys with price-cutting bolos drawn on competitors who believe that honestly made goods are worth a fair price that carries a reasonable profit and should not be sold below cost. It also keeps the whole morale of the industry low; it destroys our self-respect; it prevents us from paying our employees what other industries will pay the same men; it makes our industry unattractive to the kind of men we ought to draw into it as engineers and salesmen; and it pays the industry's investors a smaller dividend than they can get on stocks bought in the open market whose earnings are not so fluctuating and whose stockholders do not run the same risks that ours do.

Frankness about Prices

If we now stamp out that kindergarten method of burden calculation, after the next boom we shall have less demoralization, and less worry. Let us openly tell the world about the demand fluctuations this industry encounters and why its bad load factor necessarily increases a burden rate to a figure much higher than one in a more stable industry. Let us study these things ourselves and see that our customers recognize these costs as necessary parts of price, and we shall have no difficulty in getting fair prices for our product. Unless we study these things our customers will not be convinced that the facts really exist.

The man who is ignorant of his true costs never has a firm basis for his price policy and can never command respect, either of his competitors or of his customers.

In the cycle we are now entering our members should so well revise their cost systems as to prevent their repeating the errors of the past. Regional accountants' meetings every three months would do wonders in that particular, and the results of such meetings would repay their cost many fold. I ask our incoming Board to well consider the advisability of such meetings.

Activities Respecting Amortization

Some buyers have put excessive pressure on our members because such buyers have a very different situation as to demand than our industry has. It is good work to make plain to all the world that we must operate our business according to the nature of its demand. Ours is a secondary demand that increases and decreases with demand for the products of our customers and is affected only slightly, if at all, by the price of our product. We all know that when our customers' shops are largely idle, no price above a free gift will induce them to buy tools that they have no reasonable prospect of using. We cannot stimulate our market when direct costs of building machines are lowered, that is, during years of depression. Our customers buy when active business requires more production, and when the buyer feels sure that a profit will inure to him out of the larger product of our machines. If and when a user cannot figure such a profit, whether times be good or bad, his ears are shut tight to the song of the machine tool salesman.

We could never gouge our customers if we tried, because they could all make machine tools in their own shops if our prices were so high that the cost and trouble would be less in making their own machines. The seller can never break through these natural limits to price that protect the buyer. Protected in this manner the buyers have never yet had to pay prices anywhere near the point where they would better make their own machines. The business struggle has gone on between the sellers, outside the buyers' breastworks rather than between buyers and sellers on the breastworks.

Even here sellers in their eagerness to reach the buyer have not protected their inventions with as many or as good patents as they could, and they have reduced their fair rewards by leaving themselves wide open to competitive attack, even though revolutionary inventions are rare in our industry. Because of the possibility of substitution of other means to produce the same results few tight patent monopolies have been possible.

Economic law protects our customers very well, but it heavily penalizes our own deficiencies. Due to all these things, very great profits have not been reaped by machine tool builders as compared to other industries, and perhaps never can be. But at least we should learn to avoid some mistakes that have reduced or even wiped out the naturally small profits that we could earn. It is constructive service to get our members to learn to make the best of a naturally bad situation. It is constructive work to make these things clear to potential competitors so that they will not rush into this industry in ignorance and make a naturally bad situation worse.

The Problem of Finance

I am convinced that if machine tool builders will pay more attention to the financial side of their business than they have in the past, they will be well repaid for the effort. Over-expansion of an industry beyond the actual requirements of its demand is almost entirely a problem for the element holding the financial control. When a man finds that by adding only a small part to his capital investment his costs per unit will be greatly reduced, it looks like a very simple problem in arithmetic to find additional profit.

The trouble is that about the time one man gets this bright idea the same very evident fact dawns on several others. They all expand, and if the total expansion is out of proportion to the market's requirements, it is very likely that a pressure to sell will arise that carries prices below the profit point and then the additional profit anticipated by the expansion vanishes into thin air and takes some of the previous profit with it.

The financial effect of excess capacity is to reduce the value of all the investment, not only in the concern that has the excess, but in the whole industry. Capital locked up in fixed investment is simply lost if it cannot be put to profitable use. A business is worth only what can be made out of it. If it cannot earn dividends on the investment, it is only worth salvage value.

The loss and gain problem in the final analysis is a problem of finance, and as it is the financial element that takes the risk and must always hold the purse-strings, it must therefore be the one to exercise the final responsibility. No business can afford to neglect this element and certainly no business subject to such irregularities as ours is safe in doing so.

Picking Them Out

By Entropy

It is reported that several large firms will pick out their employees, big and little, by psychological tests as business resumes its upward tendency. Tests of one kind or another have been before the public for several years. They have been pretty consistently laughed at and yet they persist. The Edison questionnaires met more widespread ridicule, when they were first reported, than any other, presumably because of the fame of their author. But each succeeding test has sent more men scurrying for their encyclopædias to discover the answers and get ready to take a similar test if it should come their turn to do so. From these tests down to plain intelligence tests and trade tests of the simplest nature is only a moderate step and one that is very likely to follow.

It is pretty generally conceded, among employment managers, that selecting the right man for the job is comparatively easy as long as they can personally attend to it, but that, as soon as the plant needs men fast enough to keep several subordinates at work, there is no uniformity in their work. Consequently they would all like to discover some way to standardize the work so that all assistants in the hiring office will send about the same kind of men for each different kind of job. The general manager is concerned about this too because he realizes that he is not to have a perfect selection of men, no matter what his plan. He cannot expect to attract all the best machinists or pattern makers to his shop, realizing that others can play that game as well as he. He is better off with a fairly uniform selection if his tools, methods of manufacture and foremanship are adapted to that type than he will with a few high-grade men and some at the other extreme.

Methods of Selection

There are two ways of looking at the selection of men. One is to try to find the man best adapted by experience and training to go right ahead and do the work in the shop, while the other is to try to find the men who, when trained, will make the best men.

The first plan discovers the men whose experience comes the nearest to that which they will have in the new shop. It attracts the wanderers who, by virtue of much travel from shop to shop, can pass any kind of a trade test except a test for stability. It works well in a manufacturing machine shop where no great effort is made to keep men, where new men are wanted who will work for a while, leave all their good ideas for the superintendent to use, and, when their oranges are squeezed dry, will move on to some other place. They make for a high labor turnover but a low cost of replacement.

The second plan attracts young men whose ambitions are stirred by the promised chance to learn a trade or a profession. It is expensive in first cost because the cost of training is high regardless of whether it is concealed in the cost accounts or made the subject of a special ledger account of its own. It does produce a low labor turnover and undoubtedly in that way repays the first high cost as soon as it is running in full swing. Moreover, it makes a strong organization of men loyal to the shop, whereas the first plan makes a loose organization in which every man sees only a stepping stone to another job.

For the first plan, trade tests which show the technical skill of the applicant are all that is necessary. These tests, however, cannot be entirely verbal, the veriest manual training school boy could pass many of them verbally, but should be operative. The man should have certain jobs to set up and do before the eye of the examiner and he should be marked not alone on what he accomplishes but by the way he goes at it. For this purpose, it is essential that the examiner be broad minded enough to give the man full credit for successfully doing, in his own way, a job which he never saw before provided it is a workmanlike way and can be made efficient. Under the second scheme of tests, the intelligence test plays a great part, plus sufficient additional to show that the man has the special aptitudes that the trade requires. For example, the machinist trade is based very largely on ability to measure.

Must Distinguish Measures

A man on lathe, planer or milling machine works as close as he can measure and no closer. If the candidate shows inability to close a micrometer alike on two pieces of the same size he should be looked upon with question. If he cannot distinguish measurements with a rule as fine as 32ds he can hardly be expected to learn to read thousandths. Mathematical tests will also disclose the kind of men who can think in figures. Estimating tests, in which men are given short pieces of one, two and three inch bars to estimate without any means of measurement, will help, but the general intelligence test, with care to make sure of the man's general reasoning power and his imagination for things seen, gives the basis for a decision which will probably be at least as good as that of the employment manager himself.

The free use of tests is likely to bring about one condition that has not hitherto been met, except in connection with the civil service. Men will take many of these examinations with the idea of laying an anchor to windward. They may have no intention of accepting the job but they want to know how they stand. Men are just as curious, regarding their actual ability relative to others in the same line, as employers are. They may take a test at the Jones shop without the slightest thought of leaving Smith but if they rank high and an immediate job is available at a higher rate they are quite likely at least to ask Smith for more recognition in the pay envelope. This, however, is not an unmitigated blessing. If Smith finds several of his men making these shifts, he will jack up his psychometrist, or whatever he may call him, and get his tests up to the Jones standard.

Safety Appliances

By C. E. Jenson

In many instances safety appliances are called for by law or ordinance. But the law is too seldom enforced. Some builders rather pride themselves on their machines and even tools being fool proof, but even after the law has demanded safety appliances for elevator hatches, gears, in fact, almost everything about the place, and the inspector has come around, which I am sorry to say is often only in the hopes of graft, danger areas and danger appliances still exist. It is up to the foreman to report them, over and over again if necessary, to his employer. No workman can reasonably be expected to give his best effort when he is constantly aware that his surroundings are unsafe.

Machining Gas Engine Pistons

Rough Turning in Automatic Machine—Trouble Due to Expansion Chuck Overcome by a Chuck of Special Design—A Special Grinding Mandrel

By A. W. FREEMAN

IN MACHINING pistons at the Cushman Motor Works, Lincoln, Neb., the castings are first annealed and the open ends faced by grinding on an 18-in. disk grinding-machine. The work is held by hand square against the disk, removing just enough stock to allow the piston to set flat on this surface, which is used as a clamping surface in subsequent operations.

Rough-reaming the open end is done on a Cincinnati-Bickford drilling machine, using a lathe chuck to hold the work, as shown in Fig. 1. Very little stock is removed, not more than $\frac{1}{32}$ in. For this operation we use an expansion shell reamer with a pilot at *A* approximately fitting the cored hole. The limits to which we hold this hole are plus or minus 0.0015 inches.

Rough-turning is done on a 2-in. Cleveland automatic piston machine, supplied with air equipment for operating the chuck, which is a distinctive feature in the operation. After an unsuccessful attempt to use a chuck of the expansion pin type, the chuck shown in Fig. 2 was developed.

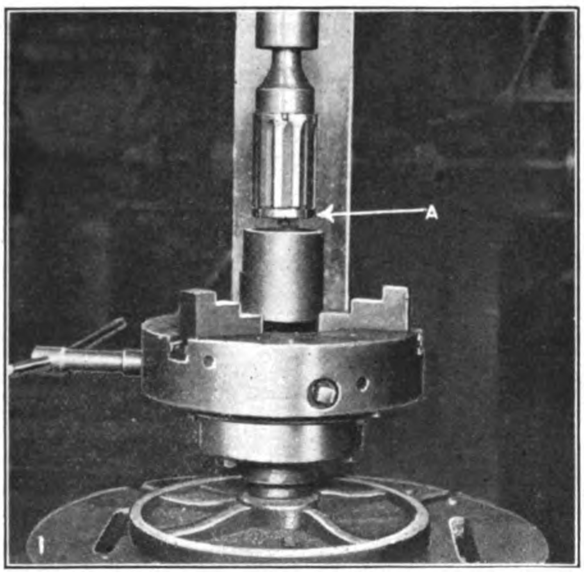


FIG. 1. ROUGH-REAMING THE OPEN END

One trouble we had with the expansion type of chuck was that the pressure would crack the piston after the roughing cut was about completed. If we reduced the pressure, the piston would wobble or run out of true when the grooving tools started to cut. Worst of all the pistons would come out of round from 0.1010 to 0.050 in. These troubles have been overcome by using the chuck shown.

The chuck holds the piston the same as it would be held by a draw bar and pin through the wristpin hole, except that it grips over the outside of the wristpin bosses, thus eliminating the necessity of drilling the wristpin holes until after the piston has been finish-turned. It also ends the troublesome job of machining across the drilled holes in the turning operation.

To chuck a piston it is only necessary to slip it over the chuck and turn on the air. There is no outward pressure against the wall of the piston, all of the pull being straight back.

The two dogs *A* when spread by the spreader block *C* will grip the wristpin bosses. The spreader block and its rod *G* are connected direct to the piston rod of the chuck. Springs at *D* collapse the chuck when the air is released. The main member *E* has a heavy coil spring behind it to force it out when air is released.

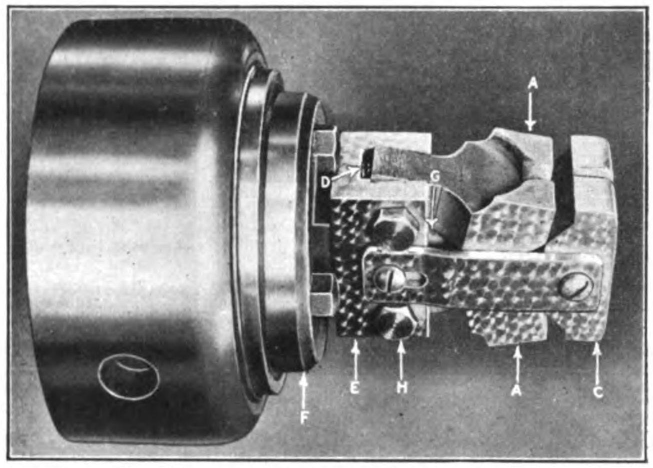
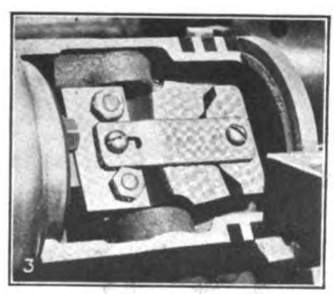


FIG. 2. A SPECIAL CHUCK

When the air is turned on, the spreader block first spreads the boss dogs to their extreme position, catching over the wristpin bosses and then the whole chuck together with the piston is drawn back against the shoulder of mandrel *F*.

All of the pull is directly over the ends of the boss dogs *A*. The spreader block and rod have swivel joints, and the holes where bolts *H* go through are slotted to take care of any variation in the wristpin bosses, giving equal pressure on each boss.

A section of a piston slipped over the chuck is shown in Fig. 3 while Fig. 4 shows the piston tightened on the chuck. Note the difference in the positions of the boss dogs in each illustration. The wall of this piston is $\frac{3}{32}$ in. thick and the first operation, which includes rough-turning the diameter, roughing the ring grooves and facing the head end, leaves it to within 0.002 to 0.004 in. of round.



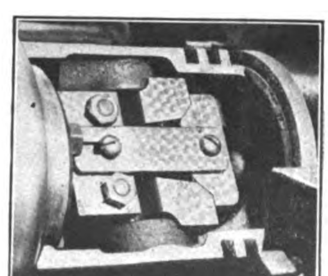


FIG. 3 PISTON IN PLACE, CHUCK NOT TIGHTENED.
FIG. 4. PISTON IN PLACE, CHUCK TIGHTENED

Boring and facing the open end is done on a No. 4 Warner & Swasey universal turret lathe. The work is held in a collet as shown in Fig. 5. The hole is bored with a two-bladed adjustable tool and reamed with an adjustable shell reamer. The diameter over the ring grooves is finish-turned with a second tool, allowing no stock for grinding.

In testing for leaks, the piston is placed in a fixture and a pressure of 50 lb. applied to the inside to determine if there are any leaks or porous places.

Boring the wristpin hole is done on a Cincinnati-

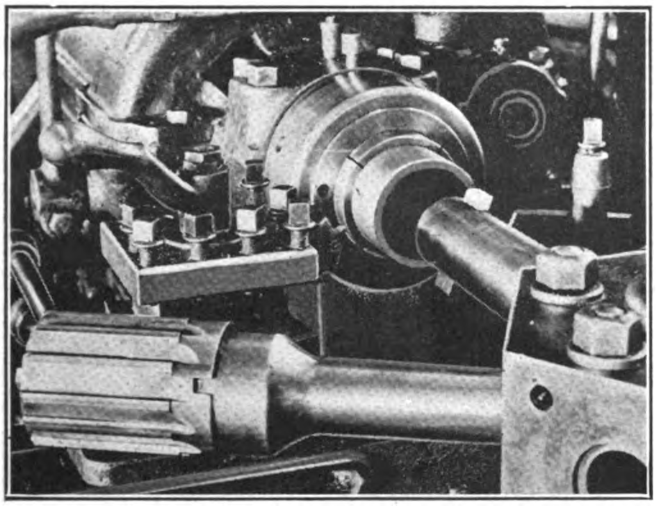


FIG. 5. BORING AND FACING THE OPEN END

Bickford 4-spindle gang drilling machine, using three spindles for the work as shown in Fig. 6. There are four fixtures. Three hold work in operation, leaving one ready to load. The hole is first drilled from both sides, turning the jig over to accomplish this. The fixture is then passed along the track to the next spindle and rough-reamed in the same manner. The finish reamer in the third spindle, however, is run through both holes from one side to insure perfect alignment. The holes are reamed to within 0.005 to 0.0015 in. of finished size. This amount is removed by hand reaming when the wristpins are fitted. Two gages are used, a limit gage and a gage to check alignment of holes. The illustration shows the locating arrangement. The yoke *A* straddles one wristpin boss. The plate *B* is hardened and ground and has a pilot to fit the open end of the piston. Screw *C* holds the piston squarely against the plate and over the pilot.

In finish grinding the diameter, the work is placed on the hardened and ground mandrel shown in Fig. 7.

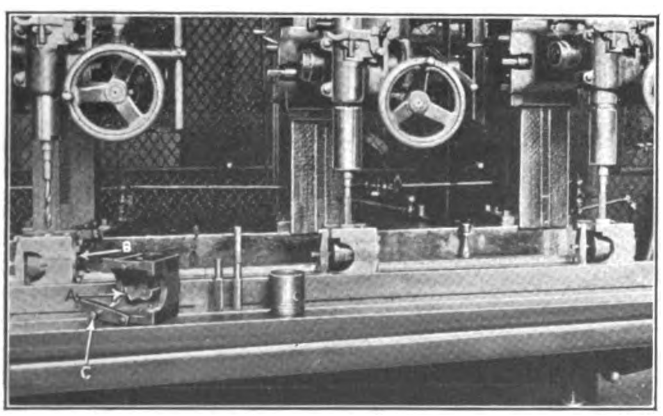


FIG. 6. DRILLING AND REAMING THE PIN HOLE

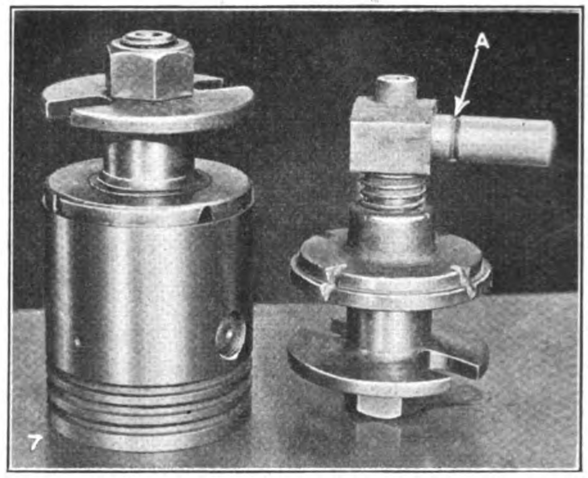
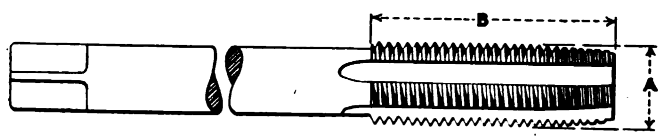


FIG. 7. MANDREL FOR HOLDING PISTON IN GRINDING MACHINE

The groove to be seen in the center of the pin at *A* is used to hold it centrally. A small ball with a spring behind it drops into the groove when the pin is in position. The four grooves shown in the mandrel will allow the grinding compound to run out. To remove the piston from the mandrel, the nut is clamped in a vise and it is only necessary to grip the piston by the hands to tighten or loosen it. A Norton 20 x 2½-in. 36-L Crystolon wheel is used, removing 0.008 to 0.012 in. of stock while feeding straight in and finishing in one operation to 3.247 or 3.245 inches.

Dimensions of Tapper Taps

The accompanying table gives dimensions of tapper taps as recently adopted by the Tap and Die Institute. It is published for the information of those interested.



DIMENSIONS OF TAPPER TAPS AS ADOPTED BY THE TAP AND DIE INSTITUTE

Diam. of Tap, Inches A	Length Overall, Inches,	No. of Threads, Per Inch			Length of a Thread Inches, B	
		U.S. Std.	S.A.E. Std.	Whit. Std.	U. S. Std. Whit. Std.	S.A.E. Std.
1/4	12 and 15	20	28	20	1 5/8	1 1/4
5/16	12 and 15	18	24	18	1 13/16	1 3/8
3/8	12 and 15	16	24	16	2	1 1/2
7/16	12 and 15	14	20	14	2 1/4	1 11/16
1/2	12 and 15	13	20	12	2 1/4	1 11/16
9/16	12 and 15	12	18	12	2 1/2	1 7/8
5/8	12 and 15	11	18	11	2 1/2	1 7/8
11/16	12 and 15	11	16	11	2 1/2	1 7/8
3/4	12 and 15	10	16	10	2 3/4	2
13/16	12 and 15	10	....	10	2 3/4	....
7/8	12 and 15	9	14, 18	9	3	2
15/16	12 and 15	9	....	9	3	....
1	12 and 15	8	14	8	3 1/2	2 5/8
1 1/8	15	7	12	7	3 1/2	2 5/8
1 1/4	15	7	12	7	3 1/2	2 5/8
1 3/8	15	6	12	6	4	3
1 1/2	15	6	12	6	4	3
1 5/8	15	5 1/2	....	5	4	....
1 3/4	15	5	....	5	4 1/2	....
1 7/8	15	5	....	4 1/2	4 1/2	....
2	15	4 1/2	....	4 1/2	4 1/2	....

Ideas from Practical Men

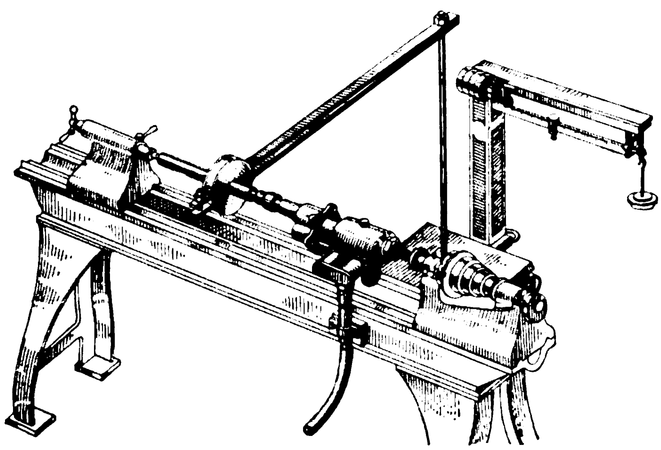
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Simple Device for Testing Power of Air Drill

By Juvenal Grignolo

On pages 875 and 951, Vol. 56, of *American Machinist*, S. Ashton Hand describes devices for testing the efficiency of air drills. These suggestions are all right for the purpose provided there are a sufficient number of drills in operation around the plant to warrant the expense of the installation. The sketch accompanying this article shows a device used by the writer while repairing drills around a small shipyard that has at least the merit of low cost.

A short shaft was made with a tapered shank to fit the socket of the drill and to it was keyed a flanged pulley, or brake wheel, about 8 in. in diameter. A forged brake band was made, as the sketch shows, and was lined with leather to fit the brake wheel. To test a drill, the shaft and brake wheel should be put into the drill and the whole placed between the centers of a lathe. The brake band should then be separated and placed over the wheel, being then drawn tight by means of the bolt at the short end. When in position, the long end of the brake band lever extended horizontally over the front shears of the lathe and was supported in this position by a long rod, the lower end of which rested upon the platform of a scale placed in front of the lathe.



DEVICE FOR TESTING AIR DRILLS

Turning on the air and tightening the bolt gradually, at the same time increasing the weight on the scale beam to correspond, the resistance necessary at the end of the lever to stall the drill was thus determined in terms of weight. This device would not, of course, measure the efficiency of the drill in the matter of air consumption with respect to the amount of work done but it does measure the power a drill was capable of delivering and tells us immediately whether or not a repair drill is up to the standard. This is the really important matter.

Another Way to Catch the Thread—Discussion

By Jesse B. King

In an article on pages 352 of the *American Machinist*, Vol. 57, under the above title, H. O. Turnbull gives a scheme for catching the thread with a pointer. The idea is very good, but I dont think Mr. Turnbull carried it quite far enough. He neglected to tell us what would happen should the thread extend up close to a flange or shoulder, in which case his thread pointer would receive some rough usage as it is in advance of the thread tool.

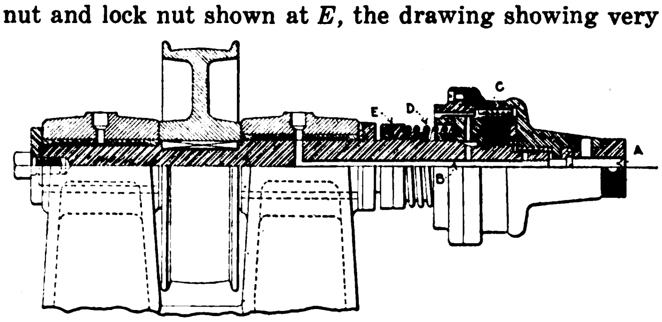
I had a similar device in use at one time on a lathe minus a thread dial and, as the work was of 1¾ in. diameter and to be threaded close up to a 4-in. flange, the rigid pointer would not do. I hit upon the scheme of hinging the pointer about ⅜ in. from the tool post. When the operator is sure the tool will follow correctly, he can swing the pointer up where it will not cause trouble and set it down again before starting the next cut.

Friction Chuck for Tightening Nuts

By Herbert Crawford

The illustration shows a friction chuck used by the Ford Motor Co. for screwing up nuts to any desired tightness. Without going into unnecessary details of construction, it will be seen that the device consists primarily of the chuck *A* and the driving spindle *B*. These members are connected by the friction plates *C* in the same way as the friction clutches in automobile drives. Part of the disks are connected to *A* and the remaining disks to the drive shaft *B*, normal friction being secured by means of the helical spring *D*.

This friction can be readily adjusted by means of the nut and lock nut shown at *E*, the drawing showing very clearly the construction of the whole chuck. Although the chuck is shown on the end of a spindle mounted in a bench stand, the same design of chuck is used on the end of the flexible shaft when it is desired to tighten nuts in assembling units which can be handled more readily by bringing the chuck to the work. This device is designed for tightening small nuts.



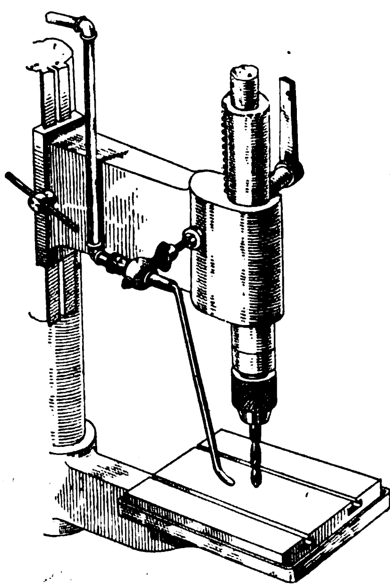
FRICTION CHUCK FOR TIGHTENING NUTS

Automatic Air Valve to Blow Away the Chips

By W. L. Kaufman

On small drill-presses used in connection with manufacturing operations, we found that it took altogether too much of the operator's time to keep the chips away from the table or fixture where the work was to go. Each time a piece was changed it would be necessary to brush or blow away the chips to make sure that none of them would get under the following piece and cause it to be drilled incorrectly.

To remedy this difficulty we piped air at 60 lb. pressure to each of the drill-presses and closed each pipe with an ordinary gas cock from the plug of which the pin had been removed so that the plug would turn all the way around. We then tapped into the end of the pinion shaft of the drill-press a large fillister head screw, the slot of which had been enlarged sufficiently to fit over the thumb piece of the gas plug and attached it to the plug by drilling through and setting in a pin, as shown in the sketch. A lock nut on the body of the screw kept it from turning in the thread and gave us an adjustment in the matter of the angle at which the slot stood. A small copper tube was fitted to the outlet end of the gas cock and bent down close to the table or fixture where the jet of air would do the most good.



AUTOMATIC AIR JET FOR SMALL DRILL-PRESS

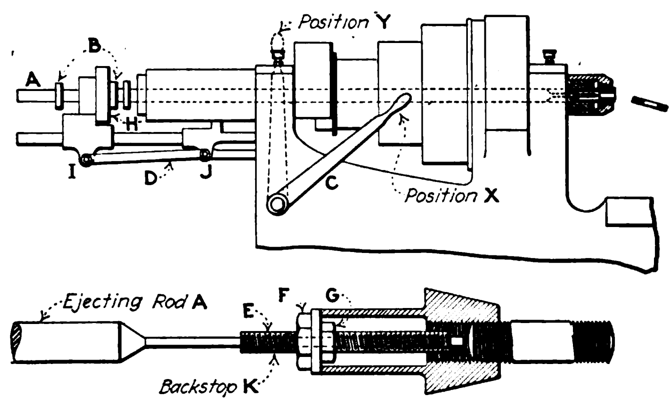
With a drill-press equipped in this way, the operator need pay no attention to the chips. When he starts to raise the drill from the work the air will automatically be turned on, while, if the lever is thrown away back, as when changing pieces, the air will be shut off again. By loosening the lock nut on the body of the screw, the valve can be set in position to deliver a jet of air at any desired rise of the drill.

A Backstop and Ejector Combination

By M. W. Taylor

The use of an ejector for the removal of work from the collets on small hand screw machines, when figured in dollars and cents, will in a year more than cover the depreciation of the machines themselves. This is especially true when the operation requires only a small amount of time, such as a second operation on work that has been partly machined on an automatic. For example, if a stud requires a ten-second threading operation (the opposite end having been previously threaded) and the time required to remove the work from the chuck is two seconds, the use of an ejector means a saving of 20 per cent of the total time. Obviously, the shorter the machining operation, the greater the saving.

The type of combination backstop and ejector illustrated in the accompanying sketch has a wider range than the so-called "spring type," generally used on the hand screw machines as there is no sticking of the spring to contend with. An adjustable backstop *K*, an ejector rod *A*, two feeding collars *B* and connecting strap *D* are necessary. The backstop and collars are equipment to be found in practically any shop. Stud *E* is a piece of steel tubing threaded and the stop can be adjusted to the length desired by moving the nuts *F* and *G*. The ejector rod is made of cold-rolled steel with one of the ends turned down so as to make it a sliding fit in the hole in the backstop. The feeding collars *B* are adjusted with setscrews.



COMBINED BACKSTOP AND EJECTOR

When the lever *C* is in position *X*, the collet is open. The piece of work is placed in the chuck until it touches the backstop and further movement causes the ejector to slide back in the hole. When the lever *C* is moved to position *Y*, the collet is closed. After the operation has been performed, and the lever moved to open the collet, the simultaneous movement of *H* starts the ejector rod through the backstop and ejects the work instantly. Connecting strap *D*, secured at *I* and *J*, causes movement of *H* in the direction in which lever *C* is moved. Casehardening of all parts adds to the life of the apparatus.

Saving Time in Grinding Centers —Discussion

By A. Chester

Charles Kaufmann's suggestion for a center to save time in grinding, published on page 234 of the *American Machinist*, is a very good one but there must either have been a mistake in the sketch or Mr. Kaufmann overlooked the fact that a sharp corner is not usually considered good design. The same idea, but with a generous round, as shown in the sketch herewith, would be much more in accordance with the general conception of good mechanical practice. Moreover, it certainly would save a lot of trouble in trying to harden such pieces.

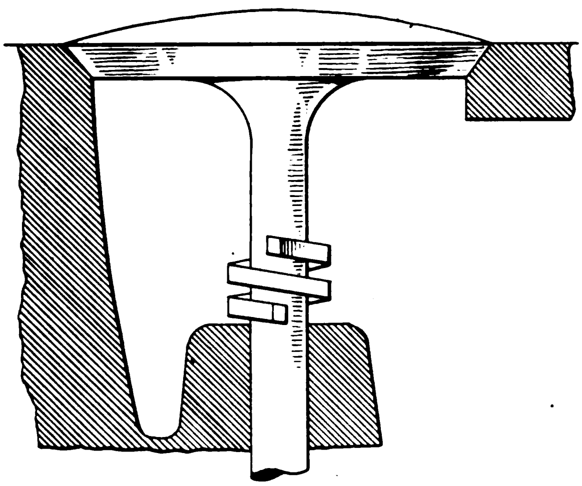
TIME-SAVING CENTER WITH ROUNDED CORNER

Rings to Keep Valves from Sticking

By G. A. Luers

Valves sticking, due to carbon collecting about the stems, is a common fault in some motors. It is necessary in some cases to remove the cylinder head and disassemble the parts to scrape the carbon from the stems. One motorist devised the simple method for scraping off the carbon as rapidly as it collects, by placing a scraper ring about the stem of each valve, as indicated in the sketch.

These rings are made from heavy square wire wound to about the size of the stems and cut off to leave two



RINGS TO KEEP VALVES FROM STICKING

turns in each ring. Another method is to use one or more lock washers about the size of the valve stem, which will effect the same purpose. The movement of the valve affords the loose ring an opportunity to reach the bearing surface each time the valve raises. Since installing these rings the owner claims not to have had a reoccurrence of valve-sticking troubles.

Slip Bushings

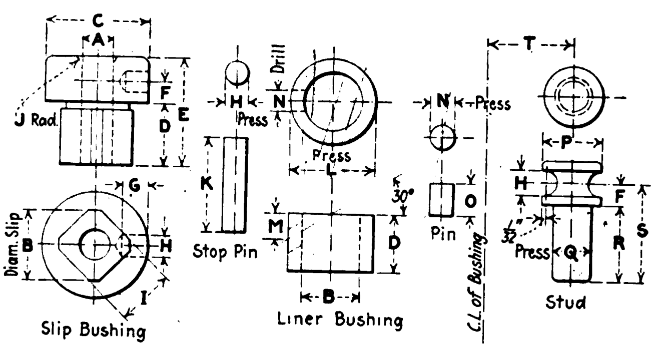
By Edward Heller

The slip bushings described by Raymond Beckman on page 152, Vol. 57, of *American Machinist* are certainly a step away from the ordinary kind and there are quite a few objections to be raised against them. In the first place, they are rather expensive to make. Secondly, the handle is pretty large (the smallest one is 2⅛ in. spread) and at times other things around the jig would interfere with it. Lastly, the chief objection to slip bushings, that of sticking, is not eliminated. Mr. Beckman only provides a big handle with which to pry them loose.

A slip bushing that does away with the chief trouble is shown in the accompanying drawing. The principal feature of the bushing is the relief milled on the part that enters the liner bushing. No matter how much dirt or grease there is in the liner bushing, the slip bushing acts as a reamer and cleans everything out. Another feature of this bushing outfit is the method by which the liner bushing is held in place. A small hole is drilled in the liner bushing a distance *M* from the top and at 30 deg. with the horizontal. After the bushing is pressed into the jig body, the small hole *N* is continued through the liner bushing, into the casting of the jig. A small pin is then forced into the hole. The hole for the pin is always drilled deeper than necessary.

If for any reason it becomes necessary to remove the liner bushing, the pin can be driven in deep enough to clear the bushing, which can then be forced out. When another bushing is inserted, it is set to miss the old hole, and a new hole is drilled for the pin. It is not often that a liner bushing has to be replaced, so the extra holes that might have to be drilled in the jig casting are negligible. This method does away with a flange on the liner bushing and it also permits the bushing to be driven in or out in any direction.

These bushings were developed and used in a shop manufacturing automobile motors and transmissions. The sizes shown in the table are the principal sizes used up to one inch. For any intermediate sizes, the dimen-



A SLIP BUSHING THAT WILL NOT STICK

sions of the next larger size were used. The parts for the more common sizes were usually made in quantities, kept in stock and when a drill jig was designed the bushings and accessories were drawn in but no dimensions given. The parts were then called for in the bill of material. It will be interesting to note that we even designed a universal drill jig to drill that little hole in the liner bushing.

SIZES OF BUSHINGS AND PARTS

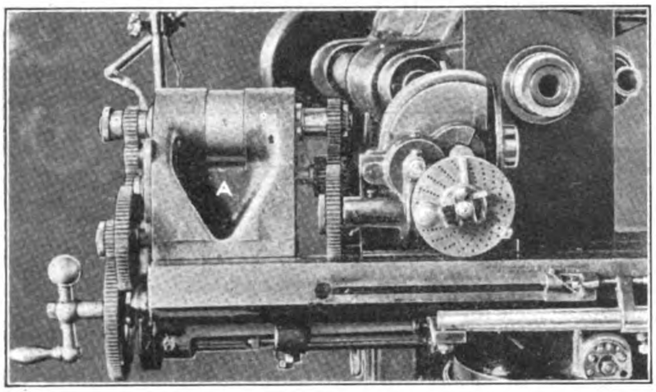
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1/16	3/16	3/8	1/2	3/4	1/8	3/32	1/16	11/64	1/32	7/16	3/8	3/32	1/16	3/16	1/4	3/16	3/8	5/8	15/32
3/32	1/4	3/8	1/2	3/4	1/8	1/8	1/16	7/32	1/32	7/16	7/16	1/8	3/32	3/16	1/4	3/16	3/8	5/8	7/16
1/8	5/16	7/16	5/8	7/8	1/8	1/8	1/16	9/32	1/32	1/2	1/2	5/32	3/32	3/16	1/4	3/16	3/8	5/8	17/32
5/32	3/8	7/16	5/8	7/8	1/8	1/8	1/16	11/32	1/32	1/2	9/16	3/16	3/32	7/32	1/4	3/16	3/8	5/8	17/32
3/16	3/8	9/16	5/8	7/8	1/8	1/8	3/32	11/32	3/64	5/8	9/16	7/32	3/32	7/32	5/16	1/4	15/32	23/32	23/32
1/4	1/2	3/4	5/8	7/8	1/8	1/8	3/32	13/32	3/64	3/4	11/16	1/4	3/32	7/32	5/16	1/4	15/32	23/32	15/16
5/16	9/16	13/16	5/8	15/16	5/32	3/16	1/8	15/32	1/16	13/16	13/16	1/4	1/8	7/32	3/8	5/16	15/32	25/32	31/32
3/8	11/16	7/8	3/4	1 1/8	3/16	3/16	1/8	19/32	1/16	13/16	15/16	1/4	1/8	1/4	3/8	5/16	1/2	7/8	1
7/16	3/4	15/16	13/16	1 3/16	3/16	3/16	1/8	21/32	1/16	13/16	1	1/4	1/8	1/4	3/8	5/16	1/2	7/8	1 1/32
1/2	27/32	1	7/8	1 5/16	7/32	3/16	1/8	11/16	3/32	13/16	1 3/32	1/4	1/8	1/4	3/8	5/16	1/2	15/16	1 1/16
9/16	29/32	1 1/8	1	1 1/2	1/4	7/32	1/8	25/32	3/32	13/16	1 5/32	9/32	1/8	1/4	3/8	5/16	1/2	1	1 3/32
5/8	1	1 1/4	1 1/8	1 5/8	1/4	7/32	1/8	27/32	3/32	13/16	1 3/8	9/32	1/8	5/16	3/8	5/16	1/2	1	1 5/32
11/16	1 1/16	1 5/16	1 1/8	1 5/8	1/4	1/4	1/8	29/32	3/32	7/8	1 7/16	5/16	1/8	5/16	3/8	5/16	1/2	1	1 3/16
3/4	1 1/8	1 3/8	1 1/8	1 5/8	1/4	1/4	5/32	31/32	1/8	7/8	1 1/2	5/16	1/8	5/16	7/16	3/8	17/32	1 1/32	1 7/32
13/16	1 1/4	1 1/2	1 1/4	1 7/8	5/16	1/4	5/32	1 3/32	1/8	7/8	1 5/8	5/16	1/8	5/16	7/16	3/8	17/32	1 5/32	1 9/32
7/8	1 5/16	1 9/16	1 1/4	1 7/8	5/16	1/4	5/32	1 1/8	5/32	7/8	1 11/16	5/16	1/8	5/16	7/16	3/8	9/16	1 3/16	1 5/16
15/16	1 3/8	1 5/8	1 3/8	2 1/8	3/8	1/4	5/32	1 3/16	5/32	7/8	1 3/4	5/16	1/8	5/16	7/16	3/8	9/16	1 5/16	1 11/32
1	1 3/8	1 5/8	1 3/8	2 1/8	3/8	1/4	5/32	1 3/16	5/32	7/8	1 3/4	5/16	1/8	5/16	7/16	3/8	9/16	1 5/16	1 11/32

Cutting Spirals of Extreme Lead

By A. B. Seaman

At times it is necessary to cut spirals having leads beyond the range provided for by the gearing of the universal milling machine.

The accompanying illustration shows a device *A* in use at the works of the Pratt & Whitney Co., Hartford,



DEVICE FOR CUTTING SPIRALS OF EXTREME LEAD

Conn., by which the range in the leads of spirals that can be cut with the regular gears can be increased or decreased by as much as ten.

As can be seen, the device is simply an arrangement for compounding the gears between the driving gear on the table screw and the driven gear on the worm of the dividing head, behind which it is placed.

Testing Push Fits by Spring Tension

By Herbert Crawford

Nothing is more exasperating than to have a gear come loose on its shaft, especially when it is part of a gear train and repairing it means dis-assembling the whole gear train. To avoid this the Neptune Meter Company, Long Island City, New York, has a very ingenious method of testing the fit of small gear wheels on their shafts, after they have been forced in place.

Two examples of their method are shown in Figs. 1 and 2. In Fig. 1 the wheel shaft is clamped in the

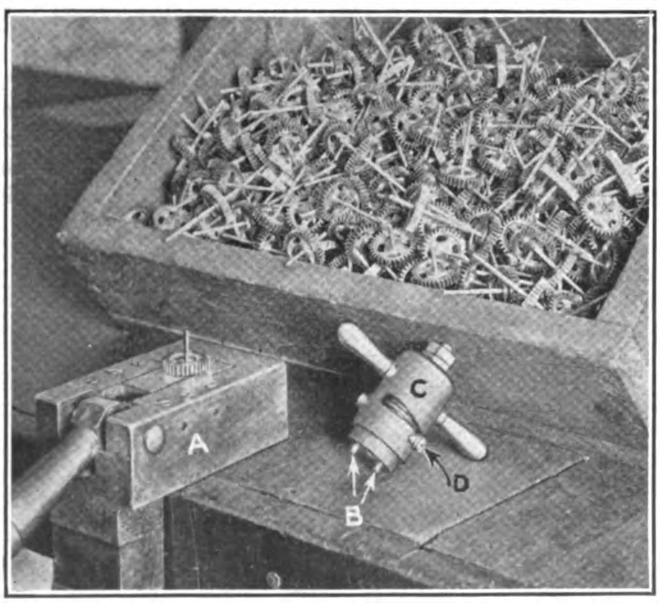


FIG. 1—TESTING FIT OF WHEEL ON SHAFT

quick acting vise *A* by the lever shown. Then the two prongs *B* of the tool *C* are placed between the spokes of the wheel and the tool turned until the screw *D* touches the other end of the slot. The two parts of the tool are connected by a helical spring. This puts the desired spring tension on the wheel, and if it does not turn on the shaft, it will stand any load that will be thrown on it in the gear train.

Another method of doing the same thing is shown in Fig. 2, except that this method tests the wheel on

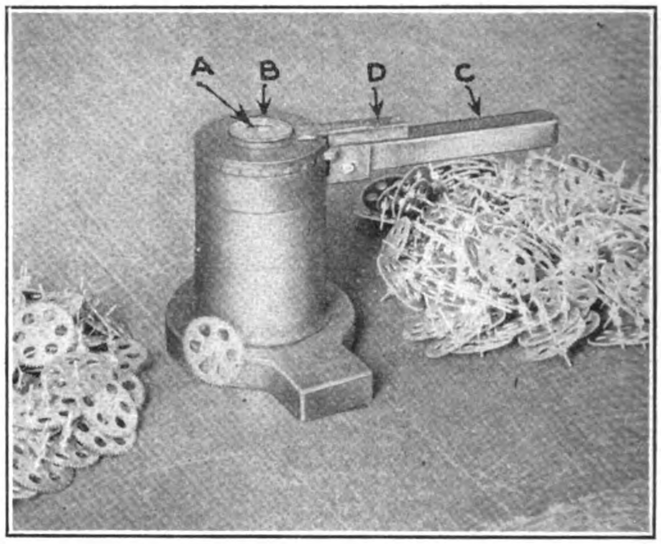


FIG. 2—ANOTHER METHOD OF TESTING HOLDING POWER OF FIT

the pinion shaft. The pinion drops into a toothed hole at *A* while one of the holes between the spokes in the wheel fits over the pin *B*. By moving the handle *C* the tension is shown by the pointer *D*. Both of these methods practically weigh the twisting load which the fit of the two pieces will stand, and prove that they will not loosen under the load exerted in service. These tests have practically eliminated the difficulties from this source.

Utilizing Fixtures on Different Machines —Discussion

By C. L. Henry

Beeston, Notts, England

The writer has read with interest the article under the above title on page 27, Vol. 57, of the *American Machinist* by Frank C. Hudson. It is true that the lack of uniform dimensions in the T-slots of machine tool tables has increased the cost of toolmaking considerably and decreased the number of production hours. It is, therefore, pleasing to know the American Society of Mechanical Engineers is considering their standardization.

The novel way of using interchangeable tongues for fixtures, as illustrated and used by the Lucas Machine Tool Company, Cleveland, Ohio, to get over the different widths of T-slots is of interest. As is customary in our plant, week by week, the contents of the *American Machinist* is read with eagerness, and the various articles discussed by the boys. After discussing this article we wondered if the cost of equipping fixtures with interchangeable tongues was worth while and we wish to explain our own method to get over the difficulty.

It was our practice to make interchangeable tongues of the plain pattern for our fixtures until about 3 years ago. Then we discovered that fixtures with narrow tongues were being used on machines with wide T-slots with satisfactory results. Since that time all our fixtures have been made with tongues to suit the narrowest T-slots and no difficulty has been experienced, while much time and material have been saved. When setting a fixture on a machine in wide T-slots it is only necessary to hold the fixture against the front or back face of T-slot and clamp it in position.

This method is undoubtedly open to criticism and we naturally conclude that, owing to the narrow tongues not being a good fit in the slots, the fixture is liable to move out of position while in use. But as tongues on fixtures are only put there to align or position them, the clamps and bolts should take all the strain and prevent them from moving.

To illustrate this, very heavy milling jobs are done in our plant using Brown & Sharpe No. 3 and No. 4 plain milling machine vices. They are not equipped with tongues to align them as the clamps and bolts hold them in position so firmly that they do not move out of alignment even under severe cutting strains.

Gage for Locating Holes from a Periphery

By C. J. Dorer

Very often after several holes have been drilled and reamed in a part, it is desirable to know the relationship between these holes and the outside edge of the part. The gage shown in the accompanying illustration was designed for the purpose of checking the relations of two holes with the outside of the disk in which they were drilled.

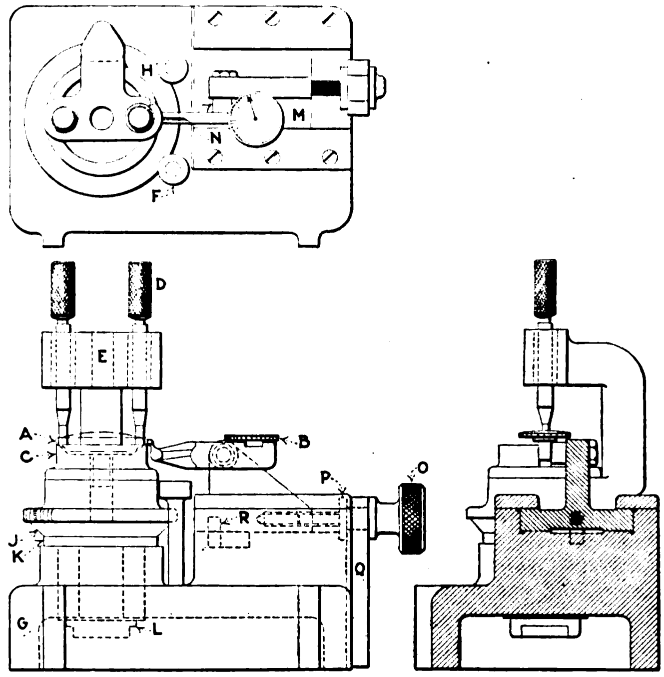
The holes in this case were drilled and reamed to a limit of plus or minus 0.00025 in. The center distance between the holes was held to a limit of plus or minus 0.0000 in. and the relation of the holes to the outside diameter was limited to a limit of plus or minus 0.0015 inch.

In checking the piece of work *A* is laid on the locating block *C*. The two plungers *D* are then pushed downward through the holes in part *A*, in which they are a close fit, and thus the piece is held tight in relation to the holes. The "Last Word" indicator *B* is moved into position, until the pointer registers on some convenient figure.

The piece *A* is now ready to be checked. This checking is accomplished by revolving the bracket *E*, which causes the periphery of the piece *A* to pass the indicator ball. The indicator pointer will register the amount of the variation in the distance from the holes to the periphery of the piece. It is not necessary to revolve the piece much over half the way around, as the opposite side of the disk will register the same amount of variation in the opposite direction; that is, minus instead of plus, or vice versa, as the case may be. The two stop pins *F* limit the motion of bracket *E* and protect the indicator against a blow from the arm of the bracket. It can be readily seen that the direction and amount of variation can be quickly determined, and, if necessary, the jig which drills the holes may be corrected.

The gage is built on a cast iron base *G*. The locating block *C* is a hardened tool steel block mounted on a bracket *E*. The plungers *D* slide freely up and down in the hardened bushings *H* which are pressed in the bracket E. The bracket E has a bearing plug J of as large a diameter as convenient, and revolves in and rests on hardened bushing *K*. The larger the bearing, the greater the degree of accuracy that can be maintained, and the more firm the bracket *E* will be. Lock nut *L* serves to keep bearing plug *J* from rising up out of place.

The indicator *B* is mounted on bracket *M* by means of stud *N*. Bracket *M* slides back and forth in ways



ASSEMBLED PARTS OF GAGE FOR LOCATING HOLES FROM A CIRCUMFERENCE

in base *G*. This bracket is moved forward and backward by revolving knob *O* which is securely fastened to screw *P*. Screw *P* has a collar which engages plate *Q* on one side and knob *O* serves as the collar on the other side, thus holding the screw in place as it revolves, and causing the bracket *M* to move.

Pin *R* is a stop pin which prevents the indicator from being jammed against locating block *C* in case bracket *M* is moved forward too far.

In order to get as accurate a reading as possible the ball of indicator *B* should move against the part *A* along a line coincident with the diameter of the part.

Soliloquies of Old Mac

When turning shouldered work in the lathe, upon which the shoulders must be accurately located with respect to each other, a scale is a very unsatisfactory tool to use for measuring the length, for the reason that it is always too short or too long, and in any event the hot chips from the tool have a tendency to curl around the operator's fingers in a way that is anything but comfortable.

To eliminate the discomfort and uncertainty, set an hermaphrodite caliper to the required dimension and then, with the caliper leg against the shoulder from which the measurement is to be taken and the hand away from possible contact with hot chips, the divider point will indicate the exact place at which to stop the tool from further cutting. More accurate work with less trouble and discomfort will be the result of using the caliper.

Editorial

A MACHINE is merely canned human intelligence. Like other canned goods it is well to examine the stuff very carefully before using, especially when it is old. It may be stale, or, worse yet, it may be spoiled and unfit for consumption. The kind of ptomaines it may stir up in your shop will not be noticed as quickly as the kind of ptomaines that wreck your inner works but the effects are none the less deadly.

A Significant Race Meet

NEAR DETROIT this week an event of unusual significance to machinery manufacturers is taking place. A race meet is being held in which the contestants in the various classes are heavier-than-air flying machines. Perhaps the connection betweeen airplanes and machinery builders seems remote, but just think back a few years.

In the early nineties there was some little interest and a good deal of derision over the first automobile race between what were really motorized carriages. Very few could see any connection between those noisy contrivances that could barely struggle through a twenty-five mile run without falling to pieces and the old and well-established machine tool industry. But what a difference a few years made! Within ten years speeds of a mile a minute were no longer unusual and then began the commercial development which revolutionized not only our methods of transportation but our methods of manufacture and our machine design as well. And what a machinery market was opened up!

Some people make the mistake of considering the airplane a competitor of the automobile. It is not and probably never can be. As a means of transportation it begins where the automobile leaves off. Its speed in a generation of men which places so much emphasis on time, counterbalances its greater cost of operation. Its size precludes its widespread use in congested districts. But who can foretell the direction or extent of its development? What prophet, twenty years ago, would have been rash enough to predict that two decades later the factories of the United States would be turning out more than two million motor cars in a single year?

The aëronautical pioneers have a harder job before them in their endeavor to educate the people to a comprehension of the possibilities of their product than the automobile men had, but they are turning to account the greater knowledge of transportation problems that twenty years of experience have given us. Where automobile races have always been speed, endurance or climbing contests for passenger carrying cars, this year's airplane meet includes events for light and heavy freight carrying machines as well as pure speed races like that for the Pulitzer Trophy. There is also an event for seaplanes.

The Detroit meet is only an incident in the development of aërial transportation but it is significant as an indication of how far and with what speed the art of flying has progressed.

Might and Right in Industrial Relations

PROGRESS OF civilization has been in a large measure a struggle between might and right. When might and right were combined in one man and one nation progress was rapid, but as a rule they were opposed to each other and progress was slow and halting, or negative. The fact that civilization has progressed is proof that right wins in the long run. Nor is this surprising, for we call that right or moral which is best for society, or at least for many, as against the desires of the few. This struggle takes place in many localities, under many different circumstances and between many different parties. Often he who is on the side of right in one issue is on the side of might in another.

There was a time when the struggle between employer and employee impressed us as if it were between might and right because the employer was only one and his employees many, and so we were instinctively inclined to take sides with the many. As the unions fought this fight we were inclined to be with them because their victory meant the greatest good to the greatest number. If the public suffered occasionally, it was willing to take its discomfort good naturedly. Where wood is hewn, chips must fly and neither one of the warring parties tried deliberately to hurt the public.

Things have changed. The coal strike was not an attempt to obtain the greatest good for the greatest number but was a display of might. The head of the miners' union did not claim that the miners were right, but that they had the power to enforce their demands. Whether the miners were right or not did not seem to interest him and was not mentioned, at least not in his public utterances.

That might has won for the present is neither surprising nor discouraging. An organized minority can always beat an unorganized majority. But such victories do not last. When the masses begin to feel the hurt and the injustice of it, they too organize and gather unto themselves the weapon of their oppressors, —Might. When might and right together combat might alone, right wins.

Progress of Uniform Cost Accounting

A CHART WORTH studying has been prepared by the Fabricated Production Department of the United States Chamber of Commerce. It shows the progress made in various commodity lines where uniform cost accounting has been achieved or attempted. The encouraging feature of the chart is the number of industries marked as being aroused to the importance of uniform cost accounting and actively engaged in pushing it. Only a few, however, have actually reached the point where a satisfactory system has been installed, although there are many more that have completed systems adapted to their respective needs.

In the statement accompanying the chart are some general truths, so-called, which may be worth emphasiz-

ing. One of them is that cost accounting uniformity is a plant of slow growth and one that requires constant encouragement. Another is that a cost system may be devised by an outside expert but that its adoption, modification to meet individual needs, and improvement must be accomplished by men of the different plants.

The Fabricated Production Department is to be congratulated for the success that has attended its efforts to stimulate interest in so vital a subject as uniform cost methods. It has a big job on its hands and needs all the support the Chamber can give it. Uniform cost accounting is a form of standardization that can be secured without great sacrifice on the part of the average manufacturer and one that will repay him and his industry many times for the effort expended.

Something About General Rules

NO GENERAL RULE should be applied with the eyes closed, not even this one. This warning is not new but it bears repeating, for there is nothing the average human being takes so gladly to his heart as a general rule. It relieves him of all responsibility in the matter at hand, gives him a weapon with which to put all critics to shame and makes unnecessary that most onerous task of all: individual thinking.

When a general rule is old enough it becomes venerable, something which cannot be said of all humans. To doubt its accuracy or investigate its merits is considered disrespectful. When still older, a general rule changes into a fetish. It then becomes sacrilege to so much as think about it in any other terms than those of submission and adoration.

In industry we find quite a number of these sainted general rules. So long as they are standing on their pedestals like idols, and are worshipped as such, they do no harm. But when they are consulted, they, like the oracle of Delphi are liable to start a lot of trouble. The courageous man asks them for advice which he follows only when his own mind tells him that it is proper.

Take, for instance, the general rule that the product should move through the shop in a straight (meaning continuous) line. Any other system is inefficient. We wonder how many millions of dollars have been sacrificed on the altar of this idol.

This rule looks good, in fact, is good if—. And this is exactly what we should say whenever we quote a general rule: If all other conditions are the same, and, if it does not cost more to apply the rule than to leave it alone, this rule, like all others, has its merits.

Some time ago we were in a very well conducted shop. The buildings, however, were old. The place had just grown and all departments were not exactly where they might have been. The general manager apologized for the lack of continuity in the line of movement of his product. He pointed out that a trucker had to move his stuff 300 ft. and back again, just because the buildings were as they were, and not as they should be.

A few questions brought out the fact that this happened five times a day, that the amount of unnecessary travel was 3,000 ft. per day for one man with a truck. We asked the G. M. how much money, he thought, could properly be spent to correct this evil and he smiled and grew more satisfied with himself and his shop. There are many cases where thousands of dollars have been spent for less cause than we saw in that shop. But then, there was a general rule which had to be obeyed.

The Increasing Use of Aerial Transport

OCCASIONALLY we run across a man who doesn't think that aviation will ever amount to much because he can't see that it has developed much since the early days. The facts are that flying has become so common that we read of very little in the daily papers except an occasional accident.

We are apt to forget that it was only twelve years ago that Hamilton flew from New York to Philadelphia and it was hailed as a remarkable feat. Yet when Lieut. Doolittle flew from Jacksonville, Fla., to San Diego, Cal., the other day in about 19 hours and with only one stop, in Texas, the papers hardly put it on the front page. Then too, we have had a twice-a-day service from Detroit to Cleveland, on schedule time, during the past summer, making the trip in 90 minutes as against 5½ hours by rail.

Perhaps the most striking instance of airplane utilization is that of Gen. Wm. Mitchell, assistant chief of air service, who has only used the railroad twice since he came back from France after the war. But this doesn't mean that he hasn't traveled, for he has flown approximately 200,000 miles during that time, visiting the various aviation centers. Railroad strikes mean nothing to him.

Aircraft development is going on in a fairly healthy fashion, and with the trend toward metal construction in place of wood, there is more and more likelihood of its being a factor in the machine building field. It is an industry to be encouraged in every legitimate manner, and machine builders should be among its boosters. Every aviation landing field is a potential market for more or less machinery, small tools and other equipment.

Just Suppose

JUST SUPPOSE all of the union railroad employees had been paying their dues regularly for the last ten years, and suppose this money had been honestly and intelligently administered, with as small an expenditure as possible for maintaining the union organization and other legitimate work. And suppose every time a union thought fit to strike it had refrained from doing so, but had made the would-be strikers contribute the amount they would have lost if they had struck a reasonable length of time.

Suppose further that all this money had been spent for railroad bonds and stocks, how many roads would now be under complete control of the railroad workers? Think of it. All the net income going to the men either as wages or as dividends. The Labor Board might reduce wages to the vanishing point and it would make no difference. And think of the beautiful chance of a union leader becoming a railroad president and riding around in his private car. Wages, working conditions, everything as the worker wants and dividends at the end of the year; a yearly vacation of not less than one month—with pay—instead of the annual strike of six weeks without pay and . . .

Of course, this is only a dream, it is not practical. There might be no dividends; the men might not be willing to pay their imaginary strike losses and besides why should a union want to do a thing like this when it would be almost certain to reduce the number of men required to run it. You cannot expect a man to kill his own job. No, it could not be done, but—

Just suppose.

Shop Equipment News

Holmes Tilted Threading Machine No. 3

A threading machine in which the spindles are tilted and which can be adapted to both internal and external threading has recently been placed on the market by the Holmes Engineering Co., Oshkosh, Wis. The machine, which is designated as the No. 3, has a capacity when cutting internal threads for taps up to $\frac{3}{4}$ in. in diameter on U. S. S. threads and 1 in. in diameter on S. A. E. threads. In Fig. 1 it is illustrated as equipped for tapping, with both forward and reverse movements for the spindles. Its particular adaptability is for work such as yokes, turnbuckles and other parts used in the manufacture of automobiles and farm machinery.

The six spindles are placed at an angle of 30 deg. from the vertical to permit of the proper lubrication of the cut when tapping, and also to allow the use of self-clamping jigs. The taps are chucked in spring collets. Four changes of speed are provided by means of change pinions and either right- or left-hand threads may be cut. Reversal of the taps at twice the cutting speed is performed automatically when the desired depth of thread is reached.

The arrangement of the work-holding jigs is such as to aid continuous tapping. Twelve jigs are employed, six of which are brought simultaneously up to the taps while the six idle jigs are being loaded. A treadle is used to move the jigs to the cutting tools, so that the operator can use both hands while unloading

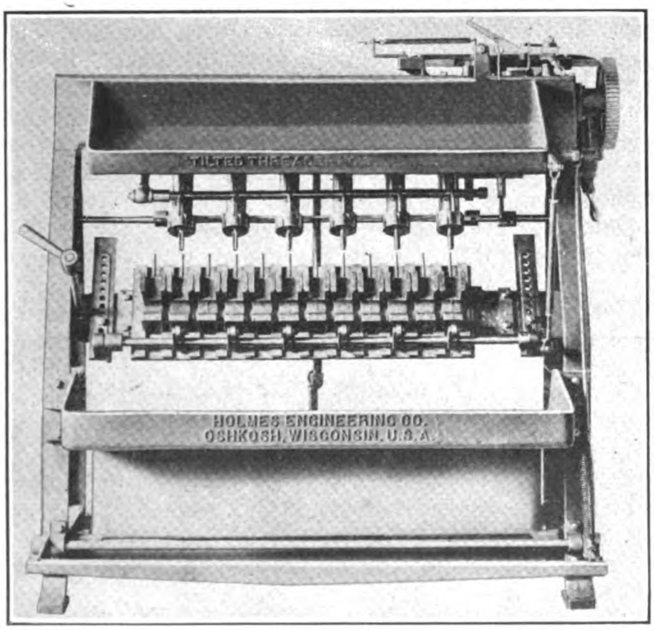


FIG. 1—HOLMES TILTED THREADED MACHINE NO. 3 EQUIPPED FOR TAPPING

and loading the idle jigs. The bedplate on which the jigs are mounted can be moved laterally on its supporting member so as to bring the proper jigs under the spindles. Feed is provided by pressure on the pedal.

The tilted arrangement of the jigs and spindles can be seen in the end view in Fig. 2. This view shows

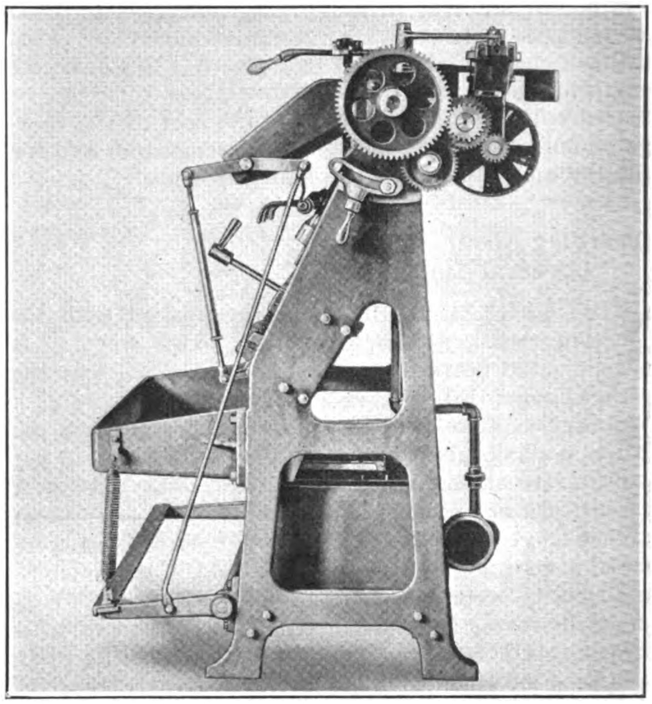


FIG. 2—END VIEW OF HOLMES THREADING MACHINE

also the arrangement of the pipes for bringing lubricant to the taps. The rotary pump forces oil to each individual spindle. A work shelf large enough to accommodate two tote boxes full of parts is located just above the spindles. It is inclined downward so that the parts are within easy reach of the operator. A trough below the jig is arranged to drain the lubricant into the tank at the rear. The arrangement of both the shelf and the trough is shown in the end view.

The machine is driven from a countershaft. Large bronze bearings are employed throughout and all thrust

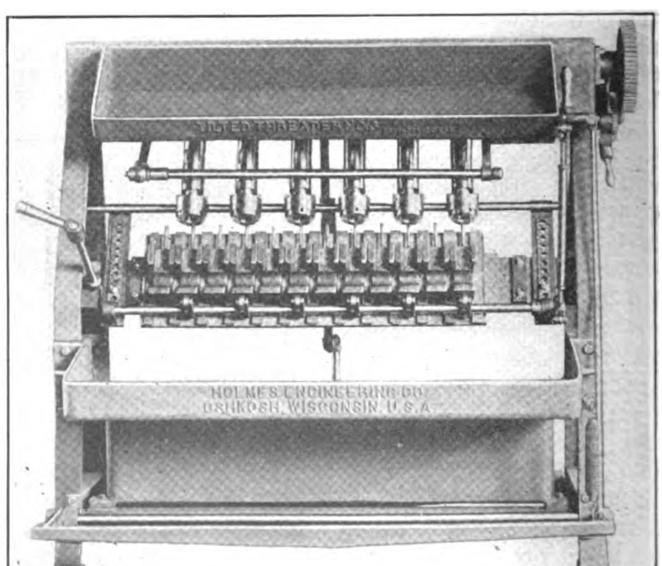


FIG. 3—HOLMES MACHINE FOR EXTERNAL THREADING

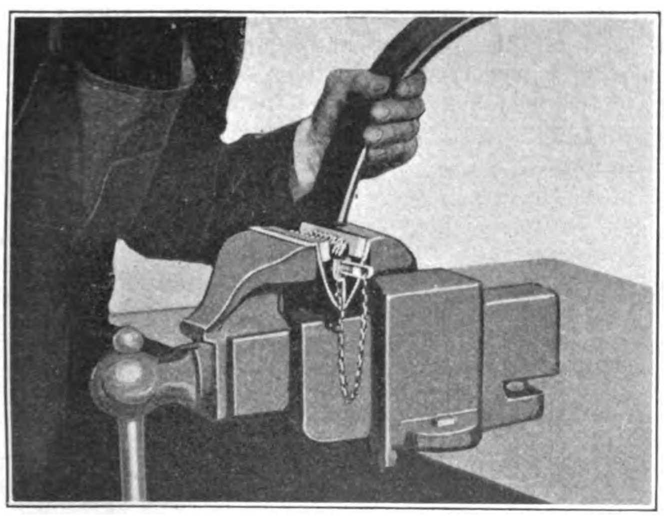
points are fitted with ball thrust bearings. It is stated that the machine is capable of production of 1,000 to 1,500 pieces per hour on average work.

When employed for external threading, the machine has a capacity up to 1 in. U. S. S. or 1¼ in. S. A. E. threads, and can be employed when threading such pieces as cap screws, king bolts, spring clips and similar parts where large production is required. It is stated that a production of 1,000 to 2,000 pieces per hour can be maintained.

In Fig. 3 is shown the non-reversing threading machine, equipped with self-opening dies. As in the previous case, four changes in speed are obtained and either right- or left-hand threads may be cut. The inclined position of the spindles prevents the lodging of chips in the dieheads, which might occur if the spindles were horizontal. The arrangement of the work-ho'ding jigs, the shelves and the lubricating system is the same as when the machine is equipped for internal threading. The machine requires a floor space of 66 x 41 in., and the height over the gear cover is 65 in.

Detroit Belt-Lace Closing Tool for Use in a Vise

A device has recently been placed on the market by the Detroit Belt Lacer Co., Detroit, Mich., by which its wire belt lacing can be applied to belting without the use of the regular bench-type closing machine made by the concern. To operate this small closing machine, a vise is necessary, as shown in the accompanying illustration. The device is normally held open by means of a spring so that it retains its position on the vise jaws. When the vise is closed, the jaws always come to the proper position to shape the lacing. The device is made of steel, while the magazine is bronze, the same as in the large standard machine. The outfit should be of



DETROIT SMALL BELT-LACE CLOSING TOOL

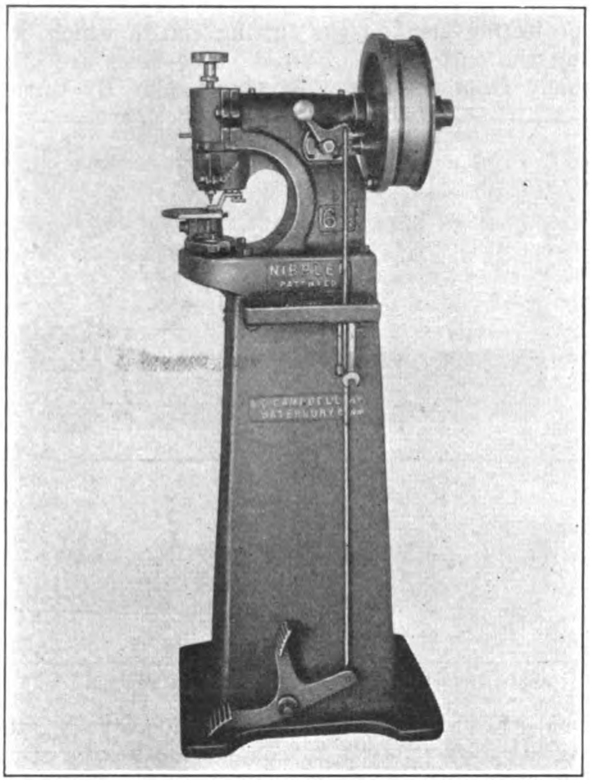
use particularly in the small shop, garage or mill where belting is employed.

The standard staggered type of Detroit wire belt lacing is employed. The hooks mounted on cards can be placed in the closing device, the belt held in position by the operator with one hand and the vise handle operated with the other. Pressure is used to sink the hooks into the belt and flatten the lacing. Rawhide pins are employed to connect the lacing on the two ends of the belt.

Campbell Nibbling Machine

A machine known as a "nibbling machine," for cutting irregular forms from sheet metal, celluloid, fiber or other material that can be worked with punch and die, has recently been placed on the market by A. C. Campbell, Inc., Waterbury, Conn. It will handle sheets of any thickness up to $\frac{3}{16}$ inch.

The machine, which is herewith illustrated, is in effect a small punch press and does its cutting by



CAMPBELL NIBBLING MACHINE

means of a small cylindrical punch and die. It runs very rapidly, and the work may be pushed or pulled in any direction by hand, following an outline marked upon the surface much as one would cut out a wooden pattern upon a jig saw, and at about the same speed. An average speed of 18 in. per minute is claimed.

The punch has a central pilot and the ram is so set that this pilot does not at any time come above the surface of the work. Thus the amount of stock that is cut out at each stroke, or the rate of feed, is governed by the difference in diameter between the punch and the pilot.

Closed outlines, as strippers for blanking dies, may be cut as readily as open ones by first drilling a small hole anywhere within the contour to be cut out. The movement of a small lever in the ram withdraws the pilot and allows the sheet to be entered under the punch without disturbing the adjustment of the ram. To start the work this lever is thrown down, entering the pilot in the drilled hole.

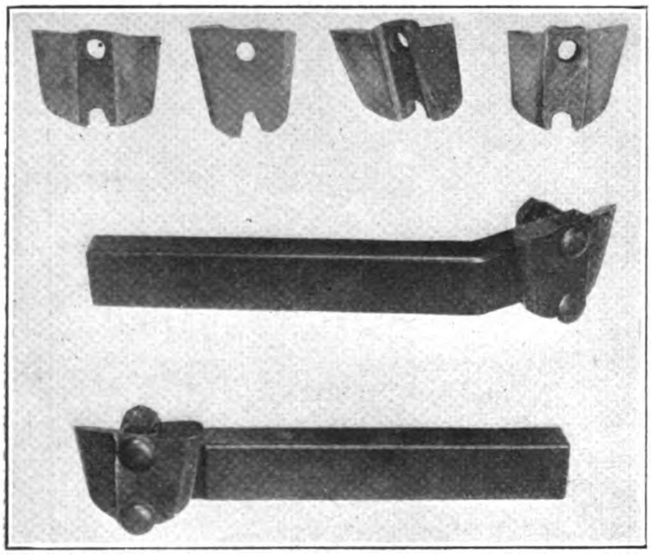
When used for repetition work a templet is first made to the desired contour, and with this attached to the sheet the machine will reproduce it without the necessity for the operator to watch a line. An attachment enables the machine to cut circles of any size up to 28 in. in diameter.

The punches are about $\frac{3}{16}$ in. in diameter and are made from a special alloy steel. They are double ended and may be reversed and replaced in a minute's time.

Morris Toolholder and Interchangeable Cutters

A toolholder and interchangeable cutters of different styles that adapt the device to practically all types of work for which a toolholder can be used is a recent product of the Morris Tool Co., Inc., 30 Church St., New York, N. Y. The illustration shows both the straight and the offset holders, as well as a number of the blades or cutters that can be fastened to these holders.

The holders are made of chrome-nickel steel and have two projecting arms at the cutting end in which bolts holding the cutters are secured. The holes are offset unequally from the center of the shank. By turning



MORRIS TOOLHOLDERS AND CUTTERS

the holder over and fastening the blade on the other side of it, it is possible to change the height of the cutting edge.

The construction of the high-speed steel blades is probably the most interesting feature of the equipment. Each blade has two cutting edges, and can be turned so as to employ either one of them. It should be noted that the cutting edge is very well supported, so that there is less danger of breaking the cutter than when tool bits of small section are placed in standard toolholders. The tools are made for turning, cutting-off, threading and facing, the method of fastening to the holder being the same in each case so that the blades are interchangeable.

The side and front angles of the cutters are always kept correct, because they are formed in the manufacture of the cutter. When sharpening, it is necessary merely to grind the top slope. Regrinding may be carried to such an extent that only a small lip remains at the bottom. Thus only a very small piece of tool steel need be discarded when the blade is worn out.

Two chrome-nickel steel bolts fasten the cutter to the holder. A bifurcated hole in the blade rests on the bottom bolt, but the top bolt passes through a hole in the upper part of the cutter. The blade is thus both supported and suspended. The construction is stated to be so firm that very heavy cuts can be taken with practically the same rigidity that results when using a solid forged tool. Because of the intimate connection of the two members and the large cross-sectional area of them, the heat of the cut is conducted from the cutting edge so that there is little liability of overheating the blade.

The tool can be applied to lathes, planers, shapers, boring mills and slotters, and is adaptable to practically any operation of cutting on these machines. A set of tools will be readily interchangeable as regards both the cutters themselves and other machines. A complete set of the tools consists of one straight, one right off-set and one left off-set toolholder, three left-hand roughing tools, three right-hand roughing tools, two 60-deg. U. S. F. or V thread tools, two cut-off tools, one right-hand and one left-hand side tool. The use of this equipment is stated to enable a large saving in weight and number of tools as compared with the forged tools and special tools required for the same work. The tools are adapted particularly to the heavy-duty work such as axle and wheel turning that is encountered in railroad shops.

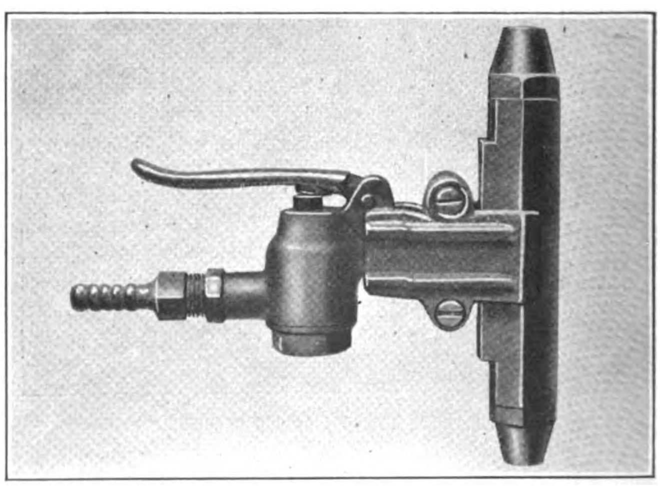
At the top of the accompanying illustration, reading from left to right, are shown a double cutting-off tool, a double threading tool, a right and left side tool, and a right and left roughing tool. The great depth of the cutting-off tool gives it rigidity. With the double threading tool, one side can be used for roughing and the other side for finishing, without moving the holder. The tool is merely turned around, and the proper angle thus maintained throughout the whole operation.

Twelve sizes numbered from 2 to 18-B are made. The holders vary from $\frac{1}{4}$ x $\frac{5}{8}$ x 4 in. in the smallest size to $2\frac{1}{2}$ x 3 x 24 in. in the largest size, and the blade thicknesses vary from $\frac{1}{8}$ to $1\frac{1}{8}$ in. The tools are normally kept in stock up to the No. 12 size, which carries a blade $\frac{3}{4}$ in. thick and has a holder $1\frac{1}{4}$ x 2 x 13 in. in size.

Pneumatic Vibrator for Foundry Use

On page 121 of *American Machinist* there was described a pneumatic vibrator for foundry use, made by the Malleable Iron Fittings Co., Branford, Conn. The clamping arrangement of the device has been changed somewhat, so that it appears as in the accompanying illustration. It was erroneously stated in the previous description that the vibrator was intended to be used for the purpose of jarring the flask when removing a cope from the pattern.

The real field of usefulness for the device is, however,

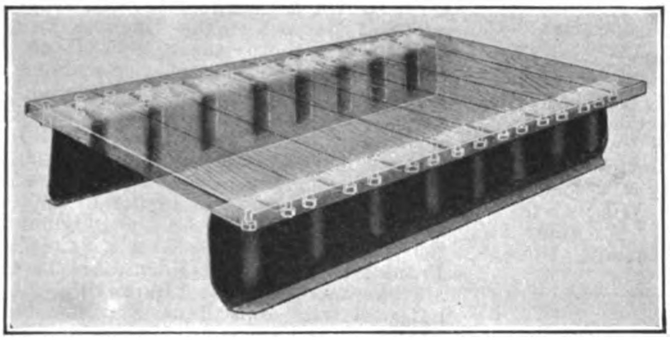


PNEUMATIC VIBRATOR FOR FOUNDRY

in the core-room, where it is used for rapping core driers or core boxes when removing the cores, to avoid danger of breakage of them. The vibrator should be attached to the air line by a sufficient length of flexible tube to enable the operator to reach any position desired. Air pressure of 20 lb. per square inch or upward is required.

Barrett "Steeleg" Truck Platform

A lift-truck platform that combines both wood and steel in its construction has recently been placed on the market by the Barrett-Cravens Co., 1328 W. Monroe St., Chicago, Ill. The construction of this "steeleg" platform, as it is called, is well shown by the phantom view in the accompanying illustration. The top of the platform is made of wood and can be from 1¼ to 2 in. in thickness, depending upon the class of work for which it is intended. Flat-head bolts fasten the boards to the steel legs or skids; they are countersunk so that they do not project above the wood.



BARRETT "STEELEG" TRUCK PLATFORM

The legs are made of heavy-gage flanged steel plate and have vertical ribs to prevent buckling. The lower flange rests on the floor and is wide enough so as not to injure or cut the floor. The upper flange has a wide bearing for the top, and its turned-up edge protects the ends of the boards. The construction is such as to make a very rigid and durable platform that is capable of continuous service under heavy loads.

The legs do not wear or shrink as wooden skids do, so that the truck can always be run under the platform, even after long use. The fact that the top of the platform overhangs the skids at the sides gives greater load-carrying capacity for the same thickness of the top boards.

"Nitrol" Casehardening Compound

The American Kreuger & Toll Corporation, 522 Fifth Ave., New York, N. Y., has just placed on the market a casehardening compound designated as "Nitrol." The compound is a nitrogenous powder that can be employed for surface-hardening iron and steel under practically any conditions. Rusty objects can be hardened as well as polished ones. A surface hardened with Nitrol is stated to be practically rustproof.

The compound is furnished in two grades, Grade A being used for surface hardening and Grade E for pack hardening to depths up to 3/16 in. The Grade A or sprinkling powder melts at 1,200 deg. F., and does not give off poisonous or obnoxious fumes. Cast steel or alloy pots similar to those employed for cyanide may be used, but the life of the pot is much longer than when cyanide is employed. Ordinarily, the articles to be hardened are immersed in a molten bath of the cyanide at a temperature from 1,375 to 1,400 deg. F. After being in the bath for from 5 to 20 min., the pieces are quenched in brine. The surface obtained is stated to be bright and free from scale.

When carburizing in pots, the parts are packed with the Grade E Nitrol and then heated in the usual manner up to 1,475 to 1,550 deg. F. for from three to eight hours. The parts are removed and quenched in the usual manner, either directly from the box or reheated to 1,425 deg. F. and quenched. The depth of the case is stated to vary from 3/64 in. for a two or three hour treatment, to 1/16 in. for from seven to eight hours. The surface obtained is smooth and free from deposit or marking. The moderate temperature required does not seriously injure the grain size of the core and thus weaken the work. Economy in the use of fuel and the longer life of the furnace resulting from the moderate temperature are also advantages of the compound. The material can be re-used repeatedly.

Whitney Roller Bearing

A roller bearing in which the rolling action is obtained by means of cylindrical disks, as shown in Fig. 1, has been developed by the Whitney Bearing Corporation, 467 East Ontario St., Chicago, Ill. The periphery of each disk is parallel with the axis, and the diameter is twice the thickness, regardless of size. Both conical surfaces of the bearing have the same angle.

The rollers operate between parallel surfaces, as shown in Fig. 2, which construction is intended to eliminate end thrust and the accompanying friction, which occur when tapered rollers are used, and to transmit the load to the face of the roller only in a direction perpendicular to the axis of the roller. The several series or rollers are carried in separate ring cages, as the rollers nearer the apex of the cone travel faster than those nearer the base.

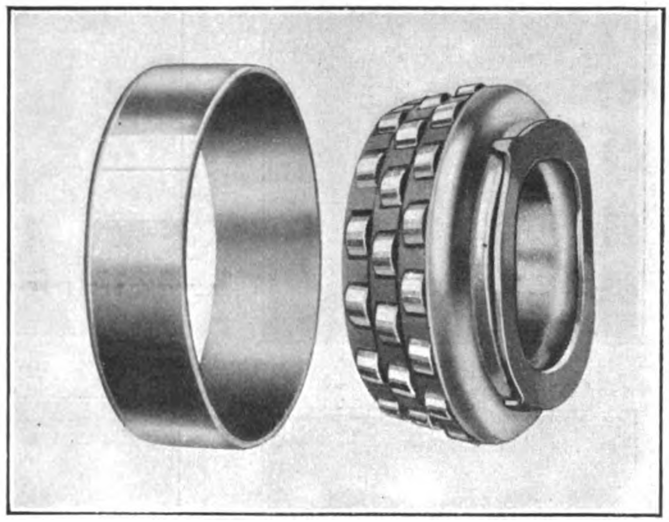


FIG. 1—WHITNEY ROLLER BEARING

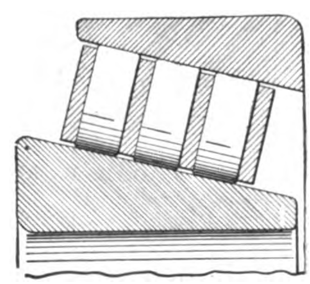


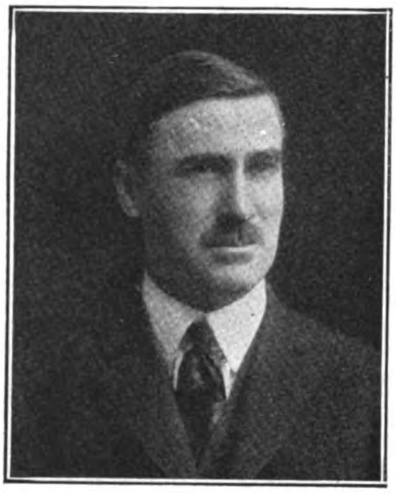
FIG. 2—CROSS-SECTION OF ROLLERS

Another feature of the bearing is the adjusting spring, which, it is said, exerts just the right pressure to keep the bearings in complete contact. The adjustment is automatic and the pressure on the bearing is uniform, assuring that all the rollers are in contact with the cone surfaces at all times. The bearings are made in all sizes, so as to fit them for a wide range of work where both radial and thrust loads must be carried.

News Section

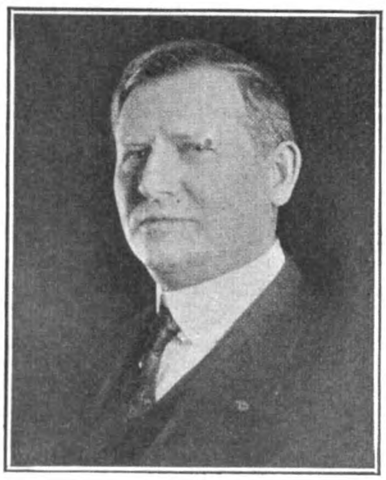
Important Discussion Features Convention of Machine Tool Builders

An innovation in connection with the 21st annual convention of the National Machine Tool Builders' Association was its being held in an out-of-the-way place, Lenox, Mass. The topics to be discussed were of so much importance that the members felt justified in getting off to themselves where they would not risk interruption, and the comments of the large number present indicated that such procedure was entirely satisfactory and the meeting a success in every respect.

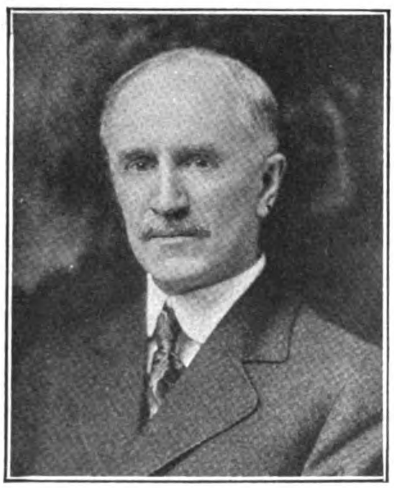


E. J. KEARNEY

WINSLOW BLANCHARD



O. B. ILES



JAMES N. HEALD

The new officers elected are: E. J. Kearney, Kearney & Trecker Corporation, Milwaukee, Wis., president; Winslow Blanchard, Blanchard Machine Company, Cambridge, Mass., first vice president; O. B. Iles, International Machine Tool Company, Indianapolis, Ind., sceond vice president; James N. Heald, Heald Machine Company, Worcester, Mass., treasurer; Ernest F. DuBrul continues as secretary and general manager with offices in Cincinnati, Ohio.

Directors are: A. H. Tuechter, Cincinnati Bickford Tool Co., Cincinnati, Ohio; C. Wood Walter, Cincinnati Milling Machine Co., Cincinnati, Ohio; E. J. Kearney, Kearney & Trecker Corporation, Milwaukee, Wis.; Winslow Blanchard, Blanchard Machine Co., Cambridge, Mass.; Howard Dunbar, Norton Company, Worcester, Mass.; Frank N. MacLeod, Abrasive Machine Tool Co., East Providence, R. I.; Edward P. Welles, Charles H. Besly & Co., Chicago, Ill.; O. B. Iles, International Machine Tool Co., Indianapolis, Ind.; James N. Heald, Heald Machine Co., Worcester, Mass.

Three days, Tuesday, Oct. 3 to and including Thursday, Oct. 5, were given over to the meeting beginning with the usual registration and business session during which the address of President Tuechter, printed in another section of this issue, was delivered. During the same session William A. Viall, secretary, Brown & Sharpe Mfg. Co., spoke on "Self Respect of the Machine Tool Trade" and there was a general discussion on the ethics of the machine tool industry.

The second session was devoted to a consideration of administrative subjects, being closed with a round table discussion. Addresses were delivered by O. B. Iles, president of the International Machine Tool Co., on "Conditions that Create Unprofitable Prices," Frank N. MacLeod, president, Abrasive Machine Tool Co., on "Improving the Sales Outlet" and Paul E. Thomas, president, Kempsmith Mfg. Co., on "Dealers' Problems."

Committee meetings were held on the second day, both morning and afternoon. In the evening Joseph K. Schofield, Chief of Patent Department, Niles-Bement-Pond Company, spoke on "What Patents Are Worth to the Machine Tool Industry." The session ended with a round table discussion on technical topics.

All of Thursday, the third day, was devoted to association affairs, including the receiving of reports and the election of officers.

Discussion throughout the convention was earnest and thorough. How much ground was covered may be seen from the following list of topics:

Administrative Subjects

1. What is a fair return on capital invested in business?
2. Do machine tool investors get fair returns compared to other industries?
3. What rate of turnover of total capital must a machine tool business have to produce a fair return?
4. What ratio should plant investment bear to working capital in the machine tool business?
5. What rate of turnover of working assets must a machine tool business have?
6. What is a fair percentage of idleness to figure on in overhead costs due to depressions?
7. How shall we get cost accounting generally in line with Scovell Wellington report?
8. What are the prospective conditions of cost-labor-material-expense?
9. On what basis should the cost and selling price of repair parts be based?
10. Can a code of ethics be drawn to advantage?
11. Elimination of everything savoring of unfair competition.
12. Would it be well to exchange experience and information as to the men who are using unfair methods?
13. How can various statistics be used in guiding financial policies?

Technical Subjects

1. Are patents in the Machine Tool Industry not good?
2. How do you get sales departments to co-operate with the engineering departments on standardization?
3. What research work would it b

well for the association to undertake?

4. What standardization is common to various types of machines?

5. How far can we go in the elimination of unnecessary sizes?

SALES SUBJECTS

1. What are the best prospective foreign markets at this time?

2. How can we secure complete information covering new developments in the machine tool line as made by leading European machine tool builders, and the specifications and prices thereof?

3. Does it pay to furnish automobiles for salesmen? Under what conditions are these furnished and what is cost of upkeep?

4. How can we raise the standard of machine tool salesmanship?

5. What percentage of gross sales is best spent on free engineering service of various kinds?

6. How far should the machine tool builders be called on to send factory representatives to close sales for which the dealer agent draws a commission?

7. What percentage of gross sales is best spent on salesmen's expense?

8. How prevalent is the demand for long time credits, and how is it best met?

9. Can we establish a uniform basis of cash discounts and standard sales terms, i. e., time?

10. What would be considered fair credit and sales terms for special machinery sold direct to purchasers and machines sold through dealers?

11. What is the best method of handling matters of credit on extended terms?

12. What is a fair term of credit to be accorded to machine tool buyers?

13. Is there any abuse of standard 30-day terms by excessive credit extension?

14. How far is free engineering service abused? (Designs, time studies, data sheets, production studies, etc.)

15. How can the duplication of engineering work be avoided, that nowadays often involves more total expense than any possible profit to the one who gets the order?

16. How can the buyer be kept from unfairly working one competitor against the other?

17. Asking sales departments to create an unnatural demand for tools.

18. Has a liquidated damage clause stopped cancellations?

19. Attitude of some purchasers in attempting unwarranted pressure on machine tool builders.

20. Exchange the best arguments and develop methods of combating unfair practices of purchasers.

21. The buyer worries about the machine tool builder's cost of production, instead of figuring the utility of the machine to himself against the price asked.

22. How can we educate the buyer on value of machines, to buy production, not pounds?

23. How long should we furnish repairs for old types of machines?

24. Credit and sales information regarding dealers and agents.

25. How does present sales organization of the industry compare with prewar conditions and how can we improve it?

26. What is fair practice when changing agents, as to taking back stock that is considered necessary to carry if the line is to be properly represented?

27. What is an equitable arrangement for division of commission between selling agents where purchases are made in one territory for shipment to another?

28. What provisions ought to be put in agency contracts?

29. What is a proper commission for agents?

30. How to get dealers to notify manufacturers of all pending deals and report progress made on same from time to time?

DEALER PROBLEMS

1. Overstocking—especially on prices guaranteed against decline.

2. Pressure of dealers for cancellations.

3. Status of dealer contracts in view of recent court decisions.

4. What is a contract of agency and one of sale? Are exclusive sales contracts valid—or binding?

Ordnance Officers and Engineers Meet at Aberdeen

This year's meeting of the Army Ordnance Association, the fourth annual gathering, was held at the Aberdeen Proving Grounds on Oct. 6 in conjunction with the Society of Automotive Engineers and the American Society of Mechanical Engineers. Great credit is due those responsible for the smoothness with which everything ran. About 500 were present to witness demonstrations of the latest developments in guns, projectiles and automotive ground and aerial equipment.

Guns of all sizes were seen in action from sub-caliber machine guns to 16-inch railroad mounts. Tanks, tractors and trucks were maneuvered about the field, bombs were dropped from airplanes and plenty of time was allowed for inspection of every type of equipment from a non-rigid dirigible balloon to an automatic pistol.

Perhaps the most spectacular event was the controlling of a whippet tank by means of orders given over a radio sending set. It was almost uncanny to watch the little tank turn and twist at commands spoken in an ordinary tone by an officer half a mile away.

Almost equally spectacular was the tracer ammunition firing both by daylight and after dark and the firing of phosphorus rifle grenades, but the most impressive exhibition was that of smokeless, flashless powder in the 75 and 155 mm. guns. Rounds of two different kinds of flashless powder were mixed in between rounds of service powder and the contrast between the two on the dark "main front" drew forth applause from the visitors.

Large Mexican Machine Tool Order

The National Mexican Railways have placed an order for machine tools with Jos. T. Ryerson & Son, Chicago, Ill., amounting to $308,000.

Steel Treating Convention Draws Big Crowd

The convention of the American Society for Steel Treating held in conjunction with the annual meeting of the American Drop Forging Institute which was brought to a close last week in Detroit was regarded by all present to have been the most successful in the history of both bodies.

The total attendance upon the convention was estimated at between eighteen and twenty thousand persons. Of the membership in both bodies, there were thirteen hundred present or approximately 50 per cent of the total.

The chief feature of the convention was the number of executives present and interest was centered chiefly in the exhibit which was considered to be the most successful ever held, fully one hundred more companies displaying their products than in previous years. Nearly all the machinery displayed on the floor was sold during the convention.

Tuesday and Wednesday evenings, Oct. 3 and 4 were given up to smoker and carnival frolic. On Thursday, Oct. 5 the annual banquet was held at which the chief speakers were: President Burton, University of Michigan and Frank Hook Alfred, president of the Pere Marquette Railway. T. E. Barker and W. P. Woodside, both of whom have been instrumental in establishing and furthering the interests of the American Society for Steel Treating were the recipients of founder memberships in recognition of their work.

On Thursday afternoon a bronze tablet was unveiled at Wyandotte, Mich., to William Kelly who was the first to use the Bessemer process in America.

Among the papers read during the sessions of the convention were the following: Furnace Atmospheres and their Relation to the Formation of Scale by G. C. McCormick; The Effect of Structure upon the Machining of Tool Steel by J. V. Emmons; Case Hardening by A. H. d'Arcambal; Lathe Breakdown Tests of Some Modern High Speed Tool Steels by H. J. French and Jerome Strauss; Heat Treating in Lead by R. B. Schenck; Irregularities in Case Hardened Work caused by Improperly Made Steel by E. W. Ehn; Study of Some Failures in Aircraft and Engine Parts by J. B. Johnson and Samuel Daniels; and Carburizing and Decarburizing in Case Hardening by H. B. Knowlton.

Officers elected for the ensuing year were: T. B. Lynch, Westinghouse Electric and Manufacturing Co., president; W. S. Bidle, of the W. S. Bidle Co., Cleveland, second vice president and W. H. Eisman, secretary.

Iron and Steel Men Will Meet October 27

The twenty-second general meeting of the American Iron and Steel Institute will be held in this city at the Hotel Commodore on Friday, October 27. The opening address will be made by Judge Elbert H. Gary, chairman of the board of the United States Steel Corporation. Many papers covering the different phases of the iron and steel industries are to be presented.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

AT THE annual meeting of the American Bankers' Association held in New York last week some 7,500 bank officers from all over the country were present, and with every authority from Secretary Mellon down telling them that "good times have come again" a nationwide boom should commence as soon as they get home, provided they believe what they heard.

But while the bankers may, from force of habit, discount what they were told, it is true nevertheless that an expectation of active business and good trade is general all the way from the Atlantic to the Pacific. Sales and prices are commencing to reflect it.

In their circular of last week Marshall Field & Co. of Chicago is definitely optimistic, especially in regard to cotton goods, and "customers are advised to cover their requirements up to the end of next January." John V. Farwell & Co. write in the same strain and say that "there is no reason why retailers should not feel safe in purchasing merchandise according to their normal needs." These two pronouncements from practical and successful merchants find academic confirmation in an address before the National Association of Cotton Manufacturers, in which Professor Copeland of the Harvard Bureau of Business Research predicts an unexampled expansion in the cotton manufacturing industry in the near future.

With optimism so general it is not surprising that almost everything but coal is firm or higher, and the decline in coal is regarded as a blessing by everyone but the coal dealers for whom, rightly or wrongly, no sympathy is felt. Regarding the commodity markets it is hardly necessary to particularize. The advancing tendency noticeable in wheat is probably the most important item in the week's commercial news as it implies an increase in the purchasing power of the agricultural West. But the strength of cotton in the face of a ginning report that is somewhat inconsistent with extremely small crop estimates is another significant straw in the business current of the week.

The long excepted advance in rubber has also started. Woolen goods, silk, paper, hides, kerosene, metals and sugar are all likewise firmer or higher, and making allowance for technical influences in the case of each commodity it is reasonable to expect that higher wages and the tariff will gradually lift the level of commercial values until there is another buyers' strike, of which there is no indication at present.

The National Association of Credit Men is about the only important authority that is not optimistic. In convention at Atlantic City it passed a resolution declaring that "there is no ground for believing that a business boom is in sight," and cautioning merchants against overbuying.

Most merchants are, however, inclined to think that the Credit Men are premature in their warning, for there is a general belief that stocks are unusually low and that there is less commodity speculation than for years.

The principal if not the only bad spot in the domestic situation is the increasing railroad congestion. There is a serious shortage of cars. The traffic awaiting shipment and on the tracks is enormous. Many roads have declared embargoes and there is every probability that the money market will be tightened and distributive trade blocked by the delay in the delivery of goods. The railroad managers are, however, working hard to relieve the blockade and they promise better service if consignees will but co-operate in unloading cars promptly.

> From the Atlantic to the Pacific, sales and prices reflect an expectation of active business and good trade, making the domestic situation one of promise. The biggest obstacle to a return of general prosperity is unquestionably embraced in the economic unsettlement in Europe, demanding the formulation of some definite plan of action on the part of this country with respect to war debts and a European policy.

The big railroad earnings that are expected during the last months of the year are already reflected in a firmer market for railway shares on the Stock Exchange, but I see nothing to change my previously expressed opinion that bonds and industrial securities will fluctuate hereafter inversely in relation to the money market. If interest rates go up securities will go down and vice versa. But there is no present indication that rates will go lower and the Federal Reserve Bank of New York says that they "have grown firmer and have risen fractionally" because of the increased demand for commercial accommodation.

The weekly statement of the Federal Reserve System confirms this view, for it discloses a decline of 1 per cent in the reserve ratio, which now stands at 77.4 per cent despite an increase of over $12,000,000 in the gold held.

The political as well as the financial news from Europe is encouraging. Kemal Pasha has evinced a willingness to parley that is inconsistent with an eagerness for war. Some cynics suggest that "English Sovereigns" may have brought him to a recognition of English sovereignty in the Levant, but whatever the facts it is plain that the crisis has passed for the London markets are strong and sterling exchange is higher. Marks are, however, slipping out of sight. An additional 26 billion were issued during the week ending Oct. 5 and last Friday they sold at 4½ cents a hundred in New York. This is the lowest price yet touched. The New York World estimates that Americans have lost nearly a billion dollars in buying marks and German mark bonds.

There would seem to be but little chance of any advance in the value of the mark unless an Allied loan to Germany, in which the United States shall participate, can be arranged. Of this there is little hope, although Thomas W. Lamont of the Morgan firm and Reginald McKenna, now chairman of the biggest bank in England and formerly Chancellor of the British Exchequer, both made addresses before the American Bankers Association that might be construed as intended to pave the way for some such program.

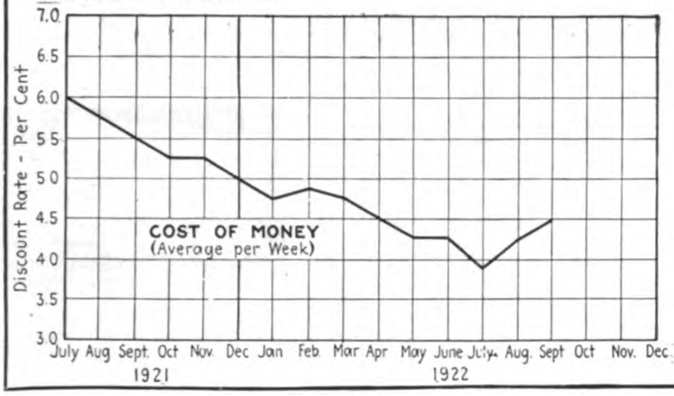
Mr. Lamont suggested waiving our claim for that portion of the debt due us by the Allies that was incurred before we commenced sending men to Europe in 1918, and Mr. McKenna very tactfully intimated that it would be good business for us to write off the sums due us by those nations who were too impoverished to pay.

From this group he specifically excluded Great Britain, who could and would, he asserted, honor her obligations. It remains to be seen whether American public opinion will be much changed by these speeches.

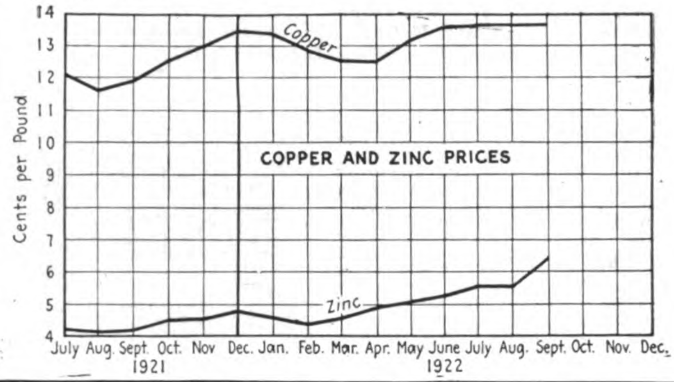
The only other sensation at the Bankers' Conference was the vociferous adoption of a resolution opposing the establishment of branches by National Banks in those states in which branch banks were permitted by the state laws. The resolution was in fact a condemnation of branch banking in general upon the theory that it would ultimately bring the credit reservoirs of the people under the control of a few men. It is an old issue in a new form. Much may be said on both sides.

It is estimated that the expenses and expenditures of the 7,500 bankers and their wives who attended the New York meeting will exceed $2,500,000 and the fact that they were willing to leave home and spend this sum is in itself encouraging in the light it sheds on financial conditions throughout the country.

They are sound, and until credit becomes scarcer and restricted the optimism that now extends from ocean to ocean seems justified.



Average weekly rates for 60 and 90 day commercial paper based on daily New York quotations furnished by the Journal of Commerce.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.

Cost of money showed no marked change during the month of September as compared with August. Prime commercial paper ruled at 4 to 4¼ per cent with a slight upward tendency. Call money showed a higher tendency. Time money was in fairly active demand, 60 day maturities ruling around 4¼ per cent with longer maturities quoted at 4½ per cent. The tendency during the latter part of September has been for the rates to harden with the increased demand for funds resulting from the West for crop movement purposes.

Copper and zinc prices, on the average, show but fractional changes during September. The average price on the New York market for the former was 13.748 cents as against 13.723 cents in August. Zinc averaged 6.110, a decline from 6.212 cents. Surplus stocks of copper are reported as being practically exhausted with Germany a heavy buyer. With an increasing demand for domestic construction and a steady export demand, producers are now asking from 14 to 14½ cents. The price of zinc appears to have softened as a result of a decrease in demand caused by the effect of freight embargoes, fuel shortage and labor scarcity on consumers.

Equipment shares advanced during September, the average price for 10 representative issues being $110.40 as compared with $104.60 in August. The high point was reached about the middle of September. Since that time there has been but a slight recession, adverse foreign news having but little effect. The car and locomotive building firms all show healthy financial statements and reports indicate a considerable volume of business booked from the railroads during September. Locomotive builders have also booked a fair volume of foreign business with numerous inquiries reported pending.

Comparative Prices of Shop Supplies

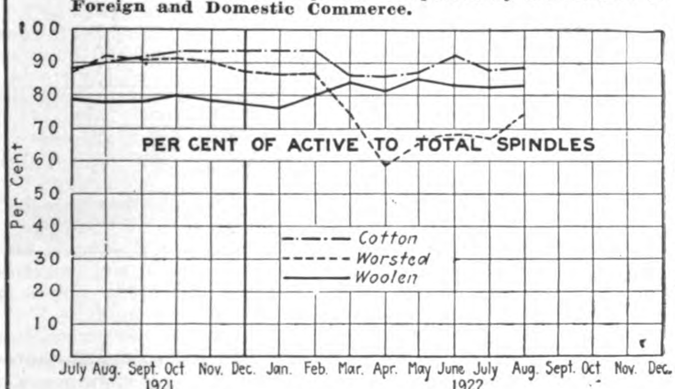
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0292	$0.0285	$0.0273
Cold finished shafting......	per lb........	0.0378	0.0365	0.0384
Brass rods.....	per lb........	0.165	0.1700	0.135
Solder (½ and ½)	per lb........	0.22	0.225	0.20
Cotton waste..	per lb........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	3.83	4.00	5.00
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal......	0.575	0.575	....
Machine oil....	per gal......	0.36	0.36	....
Belting, leather, medium......	off list........	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

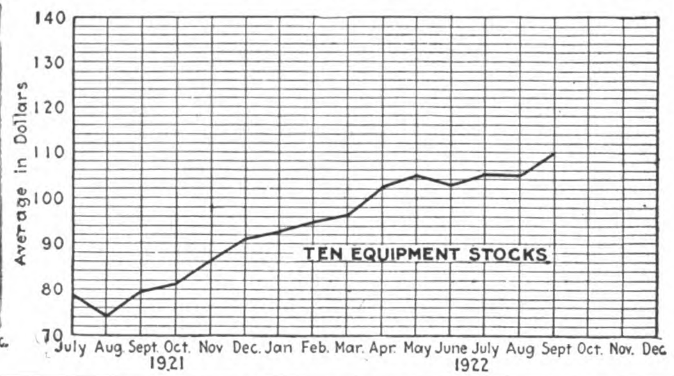
Textile industrial activity in the United States during the month of August compares favorably with the July period, September figures not yet being available. Cotton spindleage active amounted to 87.9 per cent of the total in place as compared with 86.5 per cent in July. In the woolen industry there was a fractional decline from 83.7 per cent to 82.9 per cent. Worsted conditions, on the other hand were better, active machinery amounting to 74.8 per cent of the total in place as compared with 68 per cent in July. Settlement of textile labor troubles, with a strong domestic and export demand has improved conditions.

Employment in industries, according to the Department of Labor, shows that in August as compared with July, there was an increase of 0.7 per cent in foundry and machine shops. Per capita earnings in these same industries show an increase of 2.9 per cent over the July period.

Wholesale prices in the United States during August, according to the Federal Reserve Board's index, show but little, if any change over July. Using 100 as the index for 1913, August stands at 165, the same as in the month of July.



Monthly percentage of active cotton, woolen and worsted spindles to the total in place as reported by the Bureau of Foreign and Domestic Commerce.



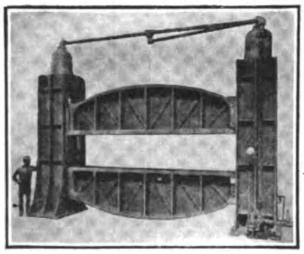
Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West'h'se A'Brake.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

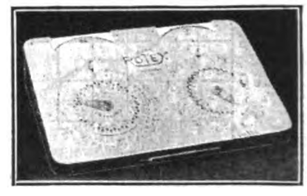
Press, Flanging, Hydraulic, Large
Hydraulic Press Manufacturing Co., Mount Gilead, Ohio
"American Machinist," August 3, 1922

The machine is used for flanging the plates for Murphy car ends and will flange cold steel $\frac{5}{16}$ in. thick by 10 ft. long. The press is equipped with two 20-in. diameter rams. Two auxiliary, 5½-in. diameter cylinders are used for returning the platen to the upper position. The press is capable of exerting a pressure of 435 tons. A three-way, poppet-type, high-pressure valve controls all the movements of the press, manipulated by one hand lever. Stroke, 24 in. Maximum distance between platens, 36 in. Weight, 42 tons.



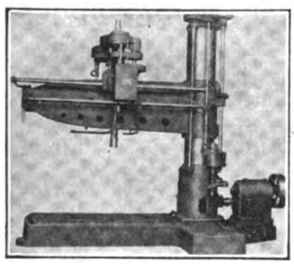
Calculator, Dimension, Rapid, "Rotex"
W. Leinert, 410 West 23rd St., New York, N. Y.
"American Machinist," August 3, 1922

The device is for mechanically adding and subtracting fractions of an inch, inches and feet when checking a series of dimensions on a drawing. It consists of a front plate carrying two circular scales, one divided into forty-eight equal parts and the other into sixty-four parts. The former scale is used for operations involving integers of feet and inches, and the latter scale for those involving fractions of an inch. When reading the results, the number of feet is indicated on the upper gear on the left-hand side, the integers of inches on the lower disk on the left-hand side and on the upper gear on the right-hand side, while the fractions of inches are read on the lower disk at the right.



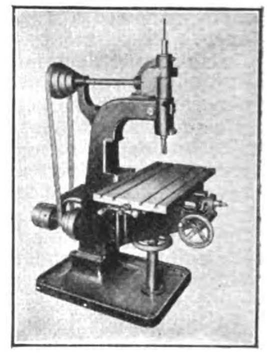
Clamping Device, Power, for Radial Drilling Machine Column
Dreses Machine Tool Co., Cincinnati, Ohio
"American Machinist," August 10, 1922

The device is for tightening the column carrying the swinging arm at each shift of the drill and is controlled from the head. No air pressure is required. The drive for the clamp is from the main vertical driving shaft which extends through the small oval box at the rear of the column. Two friction clutches in the box are incorporated in the drive, so that the screw below the box can be run either right- or left-handed for operating the binding screw. They are self-releasing and slip at either end of the movement of the tightening lever, preventing injury to the parts by over-running.



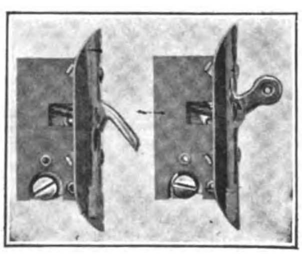
Profiling and Milling Machine, Vertical Spindle
Robbins Machine Co., 42 Lagrange St., Worcester, Mass.
"American Machinist," August 10, 1922

The machine has a crossfeed screw operated through helical gears from a handwheel that stands in the same plane as the traverse handle. The $1\frac{5}{16}$-in. diameter spindle takes a No. 3 Morse taper shank. A through hole provides for the use of a knock-out rod. The spindle runs in three parallel bronze bearings and is driven through generated bevel gears from a shaft having a four-step cone for speed changes. Work table, 16 x 30 in. Throat depth from spindle center to column face, 14 in. Table traverse, 12 in. Cross movement, 7 in. Vertical movement: knee, 6 in., spindle, 2⅜ in. Floor space, 36 x 45 in. Weight, 1,100 pounds.



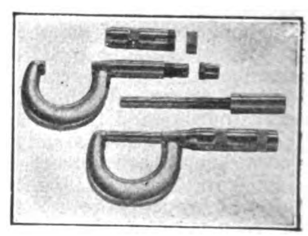
Switches, Tool-Handle, Electric
Cutler-Hammer Manufacturing Co., Milwaukee, Wis.
"American Machinist," August 10, 1922

The two types of compact electric switches are for use on small tools and appliances. The momentary-contact type of switch, at the left, is for installation in the handles of such tools as portable drills. When the operator grips the tool, his forefinger rests on the trigger, thus turning on the current. The switch at the right is provided with an operating lever, but with no spring to return the lever. It is used in appliances where the switch should remain in either the off or the on position until the lever is moved to the other position. Both devices have long phosphor-bronze contacts which engage with a wiping motion.



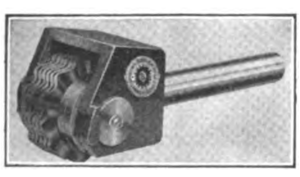
Micrometer, "Jaques Special"
Central Tool Co., Auburn, R. I.
"American Machinist," August 10, 1922

The frame of the micrometer is of oval section and is one piece with the barrel. The outer end of the barrel is split to provide a means of compensating for wear of the thread. The adjustment in diameter is made by the spring nut adjacent to the barrel. The thimble is a tight push fit over the sleeve of the measuring spindle. It is also split and provided with a knurled ring nut so that it may be clamped to the sleeve. The micrometer may be easily taken apart and adjusted.



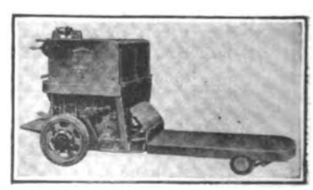
Dresser, Grinding-Wheel, Roller Bearing, Rotary Type
Desmond-Stephan Manufacturing Co., Urbana, Ohio
"American Machinist," August 10, 1922

The tool-steel disks of the device are carried on roller bearings. A stud ⅝ in. in diameter carries a cage holding the rollers of the bearing, which in turn support a bushing on which the cutters are securely fastened. The cutters are replaceable, have a corrugated form, and are 2⅜ in. in diameter. The body of the device may be used either in a toolpost or on a magnetic chuck. The shank is employed to hold the dresser in a toolpost. Used on a chuck, the device is turned over so that both the top of the body and the end of the shank rest on the chuck table.



Truck, Lifting-Platform, Electric-Driven, Industrial, 3-Ton
Automatic Transportation Co., 2933 Main St., Buffalo, N. Y.
"American Machinist," August 10, 1922

In this truck structural steel, hot-riveted in place, provides a rigid and durable, as well as a light, construction. The truck has a lifting capacity of three tons. The battery, the motor, the drive mechanism and the control mechanism are similar to those employed on previous models. Steel covers enclose the batteries and all of the auxiliary mechanism.



Clip, paste on 3 x 5-in. cards and file as desired

Business Items

Davis, Hoy and Stumpf, Singer Building, New York, N. Y., have recently been organized as dealers and distributors of metal-working machinery. The firm consists of Wm. F. Davis. L. J. Hoy and Charles O. Stumpf, all of whom were formerly connected with the Wm. F. Davis Machine Tool Co., New York. The concern specializes in used machinery.

The Triangle Tool and Die Co., advises that, in the future, inquiries regarding the Superlative Sash Cord Coupler and the Triangle Rapid Bench Saw should be sent to that company at 211 Smith St., Rochester, N. Y.

The Morse Chain Co., Ithaca, N. Y., has changed its Philadelphia headquarters to Franklin Trust Building, 18 South 15th St.

The Henry Furnace and Foundry Co. of Medina, Ohio, has declared the regular quarterly dividend of 1¾ per cent on the preferred stock.

The Atlantic Elevator Co. and the Albro-Clem Elevator Co. announce a consolidation under the name of the Atlantic Elevator Co. with headquarters in Philadelphia.

The C. F. Davis Machine Co., Inc., Rochester, N. Y., has moved into a new factory at 150 N. Water St., that city.

The Wilde Drop Forge and Tool Company has filed incorporation papers with the secretary of the state, showing a capital stock of $50,000 and 1,000 shares of no par value. The company will manufacture, buy and sell tools, machinery of various kinds, act as manufacturer's agents and brokers. The shareholders are Mary Wilde, Goldie Wilde and Paul Froeschl.

The Flexo Supply Co., St. Louis, Mo., has been incorporated with a capital stock of $10,000. The company will manufacture, buy and sell flexible pipe joint, known by trade mark as flex-o-kant leak, joints, piping, valves, pipe fittings, steam fittings and accessories. The incorporators are M. L. Evans, B. M. Brownell and Santon Fitzgerald, of St. Louis.

The American Radiator Co., has moved its Southern headquarters from Birmingham, Ala., to Atlanta, serving the group of six southeastern states and part of Arkansas. Thirty salesmen travel out of the Atlanta office, which is located at 232 Peachtree St., and is under the management of A. F. Westerfield.

The Turner Machine Co. has been organized and incorporated in Atlanta with $100,000 capital as machinery dealers in the southeastern territory, to handle all kinds of machinery, parts, tools, etc. The incorporators are J. T. Turner, 34 East 12th St., Atlanta, and Dr. A. M. Williamson, 24 Cooper St., Atlanta.

The P. H. Palmer Co., incorporated with $5,000 capital at Jacksonville, Fla., according to its application for charter, plans the establishment of a machine shop for marine machinery. P. H. Palmer is president, and Charles Atkins is vice-president and treasurer.

The Cincinnati Planer Co., Cincinnati, Ohio, announces a 10 per cent increase in prices on its vertical boring and turning mills, effective October 1.

The L-M Axle Co., Cleveland, Ohio, has purchased the plant of the Jones Gear Co., on Wayside Road and commenced the production of the L-M automobile axle, the invention of Leo Melanowski. Officers of the company are: George B. Durell, president; Warren H. Cowdery, chairman of the board and J. L. Vaughan, secretary.

Williams, White & Co., of Moline, Ill., have taken over the entire business of manufacturing and marketing the Osterholm automatic surface grinding machine, in addition to their present line.

The Brown Instrument Co., announces the opening on Sept. 1, of its Southern Branch, 619 Brown-Marx Building, Birmingham, Ala., with Charles L. Saunders in charge.

The Bonnot Co., Canton, Ohio, manufacturer of coal pulverizing and clay making machinery, has announced that its directors have declared the regular quarterly dividend of 1¾ per cent on the preferred stock payable Oct. 1, to stock holders of record Sept. 20.

The Rockwood Manufacturing Co., 1801 English Ave., Indianapolis, has awarded the contract for the construction of a new machine shop and the work has been started. The building will be brick, heavy mill fire proof construction, with a traveling crane.

The American Art Textile Co., Ft. Wayne, Ind., is planning a new factory addition, and will install much new equipment.

The Dudio Manufacturing Co., Ft. Wayne, Ind., will install in its new wire enameling plant, now nearing completion, equipment costing approximately $100,000. G. A. Jacobs is general manager.

The Commercial Shearing and Stamping Co., Youngstown, Ohio, has been reorganized with the following officers and directors elected: President, W. A. Beecher; vice president, G. F. Aledrice; treasurer, Nathan Folsom; secretary, Guy Ohl. The directors include the foregoing with the addition of C. B. Cushwa and George Donaldson. At a recent meeting the purchase of $30,000 worth of additional equipment was authorized.

The Seaboard Air Line has applied to the Interstate Commerce Commission for authority to create an equipment trust under which $2,560,000 of certificates, with interest of 5.5 per cent annually, will be issued. The money is to be used in acquiring three large special type Mikado engines, 2,150 rebuilt box cars, 850 rebuilt gondolas, and 100 rebuilt phosphate rock cars.

The Seybold Machine Co. directors at a recent meeting in Dayton, declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Oct. 1, 1922, to stockholders of record Sept. 20.

The George T. Trundle, Jr. Engineering Co., 118 St. Clair Ave., Cleveland, Ohio, makes the announcement that John F. Price has been appointed its vice president. Mr. Price was formerly comptroller of the Brown Hoisting Machinery Co., Cleveland.

Frostholm Brothers, Syracuse, N. Y., manufacturers of tools and cylinder grinders have purchased a new daylight factory at 1009 S. Clinton St., in that city. New equipment is to be installed and arrangements are being made for an expansion of the business.

The Home Accessories Corporation, recently incorporated in Worcester, Mass., to manufacture bathroom fixtures and kitchen accessories, has purchased the property at the corner of Gardner and Tainter Sts., that city, where it will begin operations in the near future.

The Hartley Clock Co., Boston, which was incorporated recently with a capital of $1,300,000, will build a three-story factory in Attleboro, Mass.

The Harris Automatic Press Co. directors at their meeting in Cleveland have declared the regular 1¾ per cent quarterly dividend on the preferred stock, payable Oct. 1.

The Angle Steel Stool Co., established about eleven years ago at Otsego, Mich., moved recently to its new daylight factory at Plainwell, Mich., the steady growth of its business necessitating larger quarters. C. E. Pipp is the president and manager of the company.

The Houghton Elevator and Machine Co. directors at a recent meeting in Toledo, have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Oct. 1.

The Computing-Tabulating-Recording Co. has announced the purchase of a factory by the company at Villengen, Germany, for the manufacture of its products for European consumption.

The Western Pacific Railroad Co. plans to add 2,000 refrigerator cars and 100 automobile cars to its equipment, according to an application made to the Railroad Commission to issue and sell $5,000,000 for this purpose.

The Bureau of Foreign and Domestic Commerce has opened a branch office in the Witherspoon Building, Philadelphia, Pa.

The Machinery Supply Corporation is the name of a new consolidation formed in Joplin, Mo., of the Joplin Machinery Exchange and the Machinery and Supply Corporation. R. M. Clark is manager and office headquarters have been established at 211 East Fourth St. D. C. Morrow of Kansas City is president and L. G. Lebow of the United Iron Works of Joplin is vice-president.

The Mott Southern Co., Peters St. Viaduct, Atlanta, distributor of plumbing and heating supplies and fixtures in the southern territory, is amending its charter, increasing its capital stock by an additional issue of $100,000, according to Charles B. Wilson, secretary.

The Standard Sanitary Manufacturing Co. opened in Atlanta the latter part of September a southern showroom for the display of plumbing fixtures and brass goods manufactured by this concern. The Atlanta address is 281 Peachtree St.

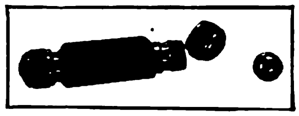
The Nashville Bridge Co., Nashville, Tenn., has acquired a site at Bessemer, Ala., and will shortly establish a branch plant there for the manufacture of steel parts for bridges, an official of the company advises.

The Director of Sales of the War Department announces that award has been made to the Republic of Poland of 7,504 European type railway cars, consisting of 75 Guerite box cars with cabs, 529 flat cars, 1,850 low side gon-

Condensed-Clipping Index of Equipment

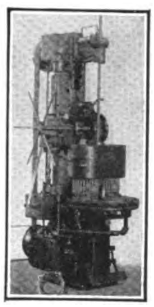
Patented Aug. 20, 1918

Gage, End, Test, "Everwear"
Central Tool Co., Auburn, R. I.
"American Machinist," August 10, 1922



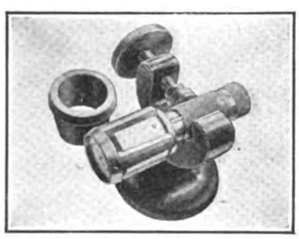
The end gage is for testing micrometers or for use in quantity production of work requiring the accurate gaging of internal diameters. The central part, or stem, is cupped at both ends to receive a $\frac{3}{16}$-in. commercial steel ball, which is retained in place by a sleeve or cup threaded to screw on the stem. As round balls give the actual measuring contacts, the gage may be adjusted to compensate for wear by loosening the sleeves and turning the balls slightly to expose the unused portions of their surfaces. After several such adjustments the balls may be discarded and new ones substituted. The gage can be furnished in any desired length above 1 inch.

Countersinking Machine, Automatic, No. 12
Fox Machine Co., Jackson, Mich.
"American Machinist," August 10, 1922



This single purpose machine is for countersinking automobile clutch plate holes. Arranged for countersinking the fifty-two holes in Hudson clutch plates, it is a three-station, rotary-table machine with twenty-six spindles in each of two groups mounted in a single head. The speed box on the top of the column is similar to others of the same make. The feed box has but one fixed movement. A geared pump located in the head furnishes forced lubrication for the spindle bearings and the spindle head gears. Initial drive is through an automobile-type dry-disk clutch at the top of the column and controlled by a foot lever at the base of the pedestal. Weight, 2,450 pounds.

Gage and Stand, Inspection, Internal
John Bath & Co., Inc., Worcester, Mass.
"American Machinist," August 10, 1922

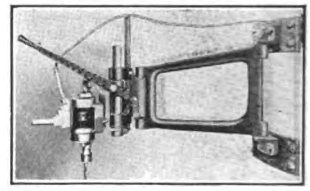


The gage is for accurately calibrating internal diameters in hardened and ground work. It is a modification of the Bath internal micrometer that measures diameters by means of a micrometer screw and sliding wedges. The tool measures variations of 0.0001 in., each mark on the thimble representing this amount. The stand grips the measuring tool by the knurled handle, which has no movement with relation to the body. Its gripping surfaces are faced with soft metal. Measuring tools can be supplied for any diameter above 1 in., and the change from one size to another can be easily made.

Saw, Bench, Portable, Patternmaker's
A. C. Sisson, 41 Bayley St., Pawtucket, R. I.
"American Machinist," August 10, 1922

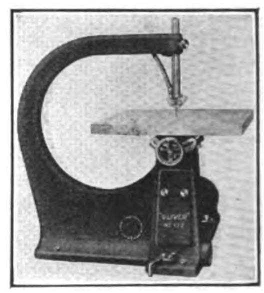
The machine is for patternmakers and cabinetmakers and may be used in jobbing machine shops where woodworking is being done. It is entirely self-contained. The arbor is belt driven from a motor that can be attached to any lamp socket. A rip fence may be set at any angle for bevel sawing, and a cut-off slide is adjustable for miters up to 45 deg. An adjustable stop attaches to the cut-off slide for duplicating lengths. The arbor will carry a 6-in. saw, and runs at 2,400 r.p.m. The table may be tilted to any angle or swung up out of the way. Table: height, 38 in.; surface, 16½ x 21½ in. Weight, 184 pounds.

Drill, Radial-Arm, Electric, for Millwrights
Van Dorn Electric Tool Co., Cleveland, Ohio
"American Machinist," August 10, 1922



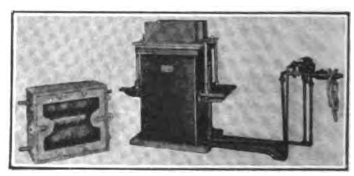
The electric drill is especially adapted to the needs of millwrights and maintenance men, and has a universal motor. The chuck holds twist drills up to ½ in. in diameter for work in iron and steel, while larger bits can be carried for boring wood. Two brackets bolted to the wall or column carry the pivots that support the arm. At the outer end of the arm is a second pivoted joint on which the short forearm swings. The drill bracket or vertical sliding members can be operated by means of the long hand lever. The cutting tool swings within a circle having a radius of 31½ in. from the wall pivots. The auxiliary forearm provides a secondary radius of 10½ inches.

Saw, Jig, Self-Contained, No. 173
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," August 10, 1922



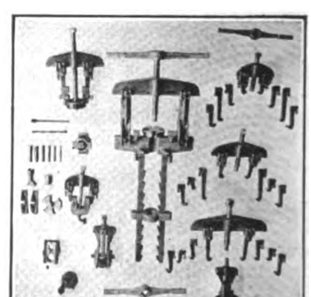
The machine is for interior and exterior scroll work in wood or other easily machined substances. No moving parts are exposed except the saw. An automatic clamping device below the table operates in conjunction with the sliding block above. The saw guides may be rotated 90 deg. in their bearings. The foot control can be operated from either position. A continuous air blast directed at the front of the saw carries away the dust. Belt drive can be provided. One dozen saws and the necessary wrenches are furnished with the machine. Table, 39 x 34 in; tilted 30 deg. right or left. Saw stroke, 3 in. Capacity, saws up to 18 in. in length.

Molding Machine, Jolt, Stripper
Arcade Manufacturing Co., Freeport, Ill.
"American Machinist," August 10, 1922



The machine has a 6-in. jolting motion operated by compressed air in the usual manner, and can be furnished with either an 8- or 12-in. length of stripping stroke. The 12-in. strip machine is placed half below the floor, but the 8-in. strip machine is placed entirely above. The flask containing the sand can be lifted straight up from the pattern, requiring only a small amount of draft. The lifting pins engaging the stripping plate or the flask are adjustable. The machine may be made with a hand-operated stripping device for small jolt cylinders. Several stripping cylinders for long flasks may be furnished.

Press, Combination Hand and Puller
Geo. W. Dover, Inc., Providence, R. I.
"American Machinist," August 10, 1922



The combination hand press and puller is for removing wheels, gears and bushings from their shafts and also for pressing them in place. Its base can be attached to the work bench. With the yoke, spreaders and anvil plate in place, it becomes an arbor press, for handling round pieces up to 18 in. in diameter. Three yokes of different lengths are supplied, each having a set of hook arms for pulling off the refractory wheels or for extracting bushings. The arms are reversible. Special hook arms remove gears and bushings from parts for certain makes of automobiles that cannot be reached with the regular equipment.

Clip, paste on 3 x 5-in. cards and file as desired

dola cars, 1,450 high side gondola cars with tarpaulin frames, and 3,600 high side gondola cars without tarpaulin frames

The F. S. Pearson Engineering Corporation, Fisk Bldg., 57th St. and Broadway, New York City, has reestablished its department for industrial management and technical auditing of industries and public utilities. This department will be carried on together with the usual work of financing, developing, design and construction of engineering projects and industrial plants.

Personals

ROBERT B. GERHARDT, electrical superintendent of the Maryland plant of the Bethlehem Steel Co., Sparrows Point, was elected president of the Association of Iron and Steel Electrical Engineers at its recent convention in Cleveland.

WALTER ENOCH, formerly head of the domestic goods department of the Wickwire-Spencer Steel Corporation, Worcester, Mass., has become president and general manager of the new Home Accessories Corporation, manufacturers of bath room fixtures, of Worcester.

DAVID JULIAN, formerly connected with the E. J. Manville Machine Co., Waterbury, Conn., is now associated with the Columbus Bolt Works Co., Columbus, Ohio, as factory manager.

B. S. LEWIS of the Stanley Works, New Britain, Conn., has been elected president of the New Britain branch of the Connecticut section of the A. S. M. E.

H. I. MARKEY, associated with the sales department of the Diamond Chain and Manufacturing Co., has been appointed manager of the company's newly opened office in the *Leader-News* Building, Cleveland, Ohio.

ALBERT J. WOODRUFF, head of the Woodruff Machinery Co., Atlanta, Ga., jobber of machinery, tools and machine parts, was nominated as a member of the house of representatives from DeKalb county in the recent Georgia primary.

PHIL CARR, who spent the past year in Honolulu, Hawaiian Islands, as a representative of machine tool interests in this country, has returned to the United States and taken up work as sales manager of the Davenport Machine Tool Co., Inc., Rochester, N. Y.

W. LA COSTE NEILSON, vice-president and general sales manager of the Norton Co., Worcester, Mass., has just returned from a European trip.

ERNEST R. LLEWELLYN, of the sales department of the Greenfield Tap and Die Corporation resigned his position with that company on October 1. He has not as yet formulated plans for the future.

WILLIAM BREEDEN, sales manager of the Lackawanna Steel Co. for the past three years, has resigned. He has been with the company both at Philadelphia and Buffalo.

JOSEPH W. ROE, president of the American Society of Industrial Engineers and professor of industrial engineering in the University of New York, addressed a meeting in Springfield, Mass., Sept. 29, held in the interest of the plan to form a local body of industrial engineers to be affiliated with the national society. The purpose and advantages of the organization were explained and progress made in the arrangements, which are now in charge of a membership committee.

CHARLES U. SMITH of St. Joseph, Mich., has been appointed superintendent of the American Malleable Castings Co. plant in Marion, Ohio. Mr. Smith was formerly foundry superintendent for the Auto Specialties Manufacturing Co., in St. Joseph.

JAMES A. BUELL, assistant general manager of the United Alloy Steel Corporation, has resigned his position to become general superintendent of the Donner Steel Co., Buffalo, N. Y.

Obituary

Herbert C. Follinger, manager of the Chicago Office of the Chain Belt Co., died of pneumonia at his home in Chicago, September 27, following an illness of but a few days. Mr. Follinger was 38 years of age at the time of his death, and was born at Fort Wayne, Indiana. In 1902 he graduated from the Chicago Manual Training School, and entered the employ of the Otis Elevator Company. He became associated with the Chain Belt Co. in 1914, and in 1916 was appointed district manager for the Chicago territory.

Book Reviews

Six-Place Tables. A pocket-size (4 x 7 in.) book of 124 pages, flexible cloth covers. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $1.25.

The small volume contains in convenient form, seven sets of tables, including those on squares, cubes, square roots, cube roots, circumferences, areas, fifth roots, fifth powers, logarithms (six places) logarithmic sines, cosines, tangents and cotangents, natural tangents and cotangents and trigonometric formulas. For those who are using the tables enumerated constantly or even frequently, the book will be worth much. In addition to the value of its contents, it is well arranged and clearly printed.

Elements of Industrial Heating. By the engineers of the W. S. Rockwell Company, New York City. 44 pages, illustrated with numerous line drawings, charts and tables. Published by the W. S. Rockwell Co., 50 Church St., New York City.

"The influence of heat upon the quality and cost of practically all manufactured products, and the comparatively inefficient methods in general use, indicate the necessity of developing a broader view of the industrial heating problem. The demand for better and cheaper products can only be met with better methods of heating and handling, better equipment, and above all, men better qualified to understand and properly apply in practice the simple principles of one of the oldest and most important, though indifferently practiced, industrial arts."

There is no doubt of the tremendous importance of the problems thus outlined in the preface of this book and furthermore there is no doubt that the engineers who have prepared it has done much for industry in furnishing this well-illustrated, effective summary of important considerations in fuel application. Much of the material in this book has appeared in pamphlets previously issued, but when this material is brought together under one cover, it again emphasizes the complexity as well as the importance of the fundamental problems as these problems are seldom stressed.

One of the purposes of this new book is to bring together in convenient form for the use of chemical and mechanical engineering teachers material that may be employed as a "supplementary text book for shop training classes, vocational schools, colleges, etc., as well as for the man in the shop and others interested in the subject." Several institutions have already announced that they expect their engineering students to use this pamphlet. If this practice is extended widely, as it well may be, we may look forward to the time when engineers will think not alone of cost of fuel per ton or the relative cost of various fuels per million heat units, but rather of that important over-all efficiency, the fuel cost per unit of quality product. In bringing out the importance of that feature, this book gives attention not alone to the selection of the fuel, but also to the selection of the furnace, the placing of the material in the furnace, and the time factor in heating.

The book does not in any way argue for any single type of equipment or any particular fuel; it affords an unusually well-balanced and impartial review of the various types of heating furnaces, annealing equipment, automatic and continuous methods and the many variations of heat-applying devices that modern technology furnishes. It will be well worth while for experienced engineers as well as those beginning their studies in engineering to look through this booklet.

Machinists' and Draftsmen's Handbook. By Peder Lobben. Third edition. Four hundred eighty 4½ x 7½ in. pages, flexible board covers. Published by D. Van Nostrand Co., 8 Warren St., New York, N. Y. Price $3.00.

A handbook is judged by its contents and by the method of their presentation. The contents in this volume include notes on mathematics, arithmetic, notes on algebra, logarithms, weights and measures, geometry, mensuration, strength of materials, mechanics, belts, rope transmission, pulleys, fly wheels, shafting, bearings, gear teeth, screws, pipes, notes on hydraulics, notes on steam, notes on copper wire, notes on electrical terms, shop notes, blue printing. In presenting the work the author has avoided the use of abstruse theories and complicated formulas. Definitions are clear and examples are well chosen. Logarithmic tables are six-place.

Factory Storekeeping—The Control and Storage of Materials. By Henry H. Farquhar. Cloth; one hundred and seventy-six 6 x 9-in. pages, illustrated. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York, N. Y. Price, $2.50.

The author, who is assistant professor of industrial management at the Harvard Graduate School of Business Administration, and is thus well qualified to write on the subject, describes a method that is practical and well worth following. He starts off with a discussion of the functions of a manufacturing plant and emphasizes the dependence of production upon material control. He ends this discussion with a summary of material losses which he claims are due to the lack of standards of variety and quality, to excessive supply, to insufficient supply and to misplaced responsibility and faulty routine.

In the chapter on material replenishment, the author gives three excellent plans for controlling supplies by the amount on hand, by the amount available or by schedule. In the next chapter are described and illustrated the balance sheets for these three plans and the information necessary for each. The duties of the purchasing department in both speculative and routine purchasing and the procedure of the receiving and inspection departments finish the discussion of material control.

The author then undertakes a description of the storeroom, dealing with the layout, equipment and storage of materials. He shows the advantages and disadvantages of a centralized storeroom, gives the details to be considered in selecting a location for the storeroom and outlines a system for indexing supplies. Several drawings of interchangeable racks and bins are shown to bring out the author's theory of double binning. His method for securing a turnover of stock is well thought out and in practice should give an efficient system of storing in regard to saving space and labor. The classification of materials and a description of material accounting, inventories and statistics finish the book.

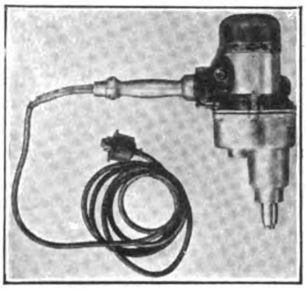
Business Analysis of United States Made by Counties. In two volumes, each consisting of an I. P. No. 2710 flexible leather binder with loose leaf index and contents. Leaves are 5½ x 8½ inches. Published by Wm. H. Rankin Co., 180 North Wabash Ave., Chicago, Ill. Price $200.

Statistics covering the following items are given by county, and by total for state: Total farm value, total crop value, total income tax, total white population, total

Condensed-Clipping Index of Equipment

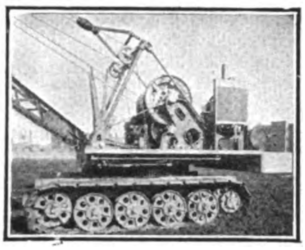
Patented Aug. 20, 1918

Screw and Nut Setting Tools, Portable and Stationary
Elecdrive Manufacturing Co., Inc., Syracuse, N. Y.
"American Machinist," August 17, 1922



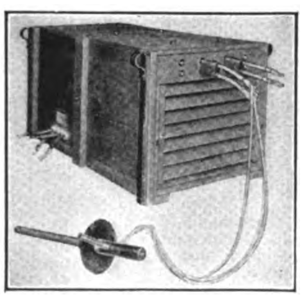
The tools are used in driving and setting screws, studs and nuts, and are made in two sizes of the portable and one size of the stationary type. Motors for both types run on 110-volt d.c. or a.c., providing the a.c. is not more than 60-cycle. The portable model operates from an electric light socket, but unless the light wiring has a large enough safety factor, the stationary one should be operated from a power line. Recessed, tapered wrenches are furnished for picking up the nuts while the spindle is running at full speed. Portable tool: capacities, $\frac{1}{4}$ to $\frac{5}{16}$ in. and $\frac{3}{8}$ to $\frac{1}{2}$ in. respectively; weights, 11 and 13 lb. Stationary tool capacity, $\frac{1}{2}$ to 1 inch.

Crane, Crawler, Heavy-Duty, Motor-Driven
Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill.
"American Machinist," August 17, 1922



The crane, operated by a heavy-duty, 4-cylinder traction engine running at 800 r.p.m., is equipped with an automatic governor, gear-driven fan, centrifugal pump, high tension magneto with impulse starter, and force feed lubrication to all bearings. The boom-hoisting mechanism is automatically self locking. The clutches for swinging, traveling and hoisting the boom, and for hoisting and holding the drums are of the expanding type. The operator can set the brakes either before or while hoisting. A 40-hp. electric motor for any standard current can be supplied to operate the crane in place of the gasoline engine. Height, 11 ft. 8 inches.

Transformer, Electric Arc, Rivet Cutter
Electric Arc Cutting and Welding Co., 152 Jelliff Ave., Newark, N. J.
"American Machinist," August 17, 1922

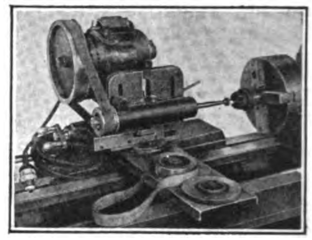


The machine is adapted primarily to rivet cutting, although it can be used also for cutting cast iron, brass or bronze. It is made in three sizes. The type CW. 300-amp. machine is intended for both welding and cutting, the 600-amp. machine for rivet cutting and carbon arc welding, and the 1,000-amp. for cutting alone. A magnetically operated switch is provided in the primary, so that the circuit remains open at all times when the electrode is not in contact with the work or when the arc is not being drawn. The small pilot transformer of 100 watts capacity makes the operation automatic and positive.

Threading Machine, Automatic, Double-Ended
Cleveland Automatic Machine Co., Cleveland, Ohio
"American Machinist," August 24, 1922

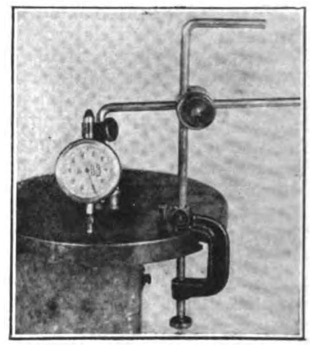
The machine is fully automatic, has two heads and is adapted to high-speed threading. It can thread simultaneously both ends of a forged or rolled staybolt, so that both threaded ends are in line and the lead is continuous from one threaded portion to the other. The machine consists primarily of a hopper, a work-feeding mechanism, a pair of floating jaws which hold the staybolt, two substantial spindles carrying the die-heads, and a large lead screw. It is equally useful for all double-ended turning and threading work on studs, pipe nipples, and short shafts. Capacity, staybolts up to 1$\frac{5}{16}$ in. in diameter; 7 to 18 in. long.

Grinding Attachment, Combination External and Internal
United States Electrical Tool Co., Cincinnati, Ohio
"American Machinist," August 17, 1922



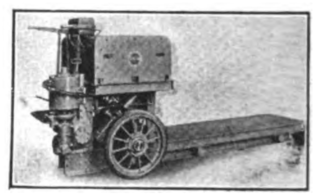
The attachment can be used on lathes with a swing as small as 10 in. The universal type motor can be operated by either d.c. or a.c. where the latter has a frequency of 60 cycles or less, and is pivoted to the angle plate. The spindle has an angle adjustment and also a vertical adjustment of 4 in., and is used for both external and internal grinding, the speed being changed by transposing the pulleys. Different lengths of wheel arbors can be inserted in the spindle. Regular equipment: three pulleys, grinding wheels for internal and external work, a wheel arbor 3 in. long, and two woven belts.

Attachment, Gage, Universal
B. C. Ames Co., Waltham, Mass.
"American Machinist," August 17, 1922



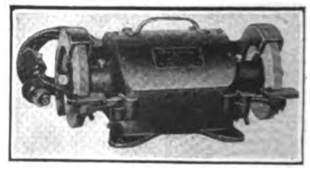
The attachment can be applied to any object within the range of the clamp and can be set so as to bring the dial gage to almost any position or angle. It can be used for testing the straightness of crankshafts, camshafts and valve cams; checking lifts of valves and valve cams; gaging thickness of piston rings, shims, bearing liners and diameters of pistons. It can be purchased without the dial gage if desired.

Truck, Platform, Elevating, 5-Ton
Atlas Car and Manufacturing Co., Cleveland, Ohio
"American Machinist," August 17, 1922



The truck is used especially in handling large core racks into and out of core ovens. The platform can be elevated 4 in. in 10 seconds. The truck may be operated by either Edison or lead batteries, the latter being standard equipment. A limit switch is operated automatically at each end of the platform travel so that the motor is stopped and the platform held in position. The brake is applied whenever pressure is released from the pedal. Three speeds are provided in each direction and steering is applied to all four wheels. The machine can be operated through intersecting aisles 8 ft. wide, while carrying a core rack 5 ft. 1 in. wide and 7 ft. long.

Grinder, Bench, Motor-Driven, "Duwell"
J. A. Finley Co., 20 Braintree St., Allston, Mass.
"American Machinist," August 24, 1922



The grinder is designed for service in machine shops and garages, for tool grinding, polishing, and wire-brushing. It carries two grinding wheels of 5-in. diameter by $\frac{1}{2}$-in. face and runs at 4,500 r.p.m. Power is supplied by a universal motor of special construction running on either d.c. or a.c. and wound for 110 or 220 volts. The wheel spindle is mounted well toward the front. The machine is provided with cord, switch and attachment plug, ready for connecting to a lamp socket. Detachable wheel guards and tool rests for each wheel are also furnished. Height from base to wheel center, 3 in. Distance between wheels, 9$\frac{3}{4}$ in. Weight, 25 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

manufacturing value, total state auto registration, total mileage of all roads, total surfaced roads, and certain information on climatology.

A preface lists the sources from which the data were obtained. For example, the data for the manufacturing values were taken from the 1919 Manufacturers' Bulletin, Department of Commerce, Bureau of Census. Manufacturing value is defined as the value of manufactured products, i. e., cost of material plus value added by manufacture.

Graphic Charts in Business. By Allan C. Haskell. Two hundred forty-six pages, 6 x 9 in., cloth boards. Published by Codex Book Co., Inc., 119 Broad St., New York, N. Y. Price $4.00.

Beginning with a well written chapter on the necessity for and the use of charts in business, the book progresses by gradual, easily followed steps through the definition of graphic charts and an explanation of their functions to a study of the simplest kinds of charts. The more complicated charts are then taken up, after which more than half of the book is devoted to showing how graphic charts are used in the various departments of businesses and factories, including the departments of accounting, advertising, collection, cost, credit, personnel, purchasing, sales, scheduling and production.

The kinds of charts treated are line, plain and ratio ruling, bar, circular, percentage, organization, tri-linear, probability. There is an undisputed value to graphic charts when properly executed and applied. How they may be prepared and where applied are subjects thoroughly covered and the book as a whole should be of real value in the analytical problems connected with the conducting of a business.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Iron and steel pipes of all diameters and lengths of good quality—Italy. Agency desired. Quotations, c. i. f. Italian port. Correspondence and catalogs should be in Italian or French. Reference No. 3639.

Chamotte, silica, and magnesite—Norway. Purchase desired. Quotations, c. i. f. Norwegian port. Terms, cash against documents. Reference No. 3640.

Hardware such as wood screws, wire nails, rose nails, annealed wire, and barbed and other wires; steel of every kind, anvils, etc.; railway materials; machinery; boiler fittings; electrical goods; cotton mill and gin requisites; plain and corrugated iron sheets; plain galvanized sheets; brass and copper sheets, etc.—India. Reference No. 3644.

Iron and steel bars, sheets, pipes, wire, and metals, tin plates, building forgings, tools of all kinds, engine fittings, screws, nails, tacks, rivets, and general hardware; oils and greases; varnishes and paints; leather and balata belting; cotton waste.—Finland. Purchase and agency desired. Quotations, c. i. f. Helsingfors. Terms, payment against documents. Reference No. 3665.

Sawmill machinery and accessories—Spain. Purchase desired. Quotations, c. i. f. Ferrol. Correspondence, Spanish. Reference No. 3714.

Machinery and equipment for the manufacture of candies, crackers, and biscuits—Italy. Purchase desired. Quotations, c. i. f. Genoa or Savona. Terms, cash against documents. Correspondence, French or Italian. Reference No. 3718.

Printing machinery and supplies—Italy. Purchase desired. Quotations, c. i. f. Genoa. Correspondence, Italian or French. Reference No. 3752.

Pneumatic drilling machines for mining operations—Spain. Purchase desired. Quotations, f. o. b. New York. Reference No. 3753.

Machinery for compressing calcium carbide dissolved in acetone—Spain. Purchase desired. Quotations, c. i. f. Barcelona. Payment, cash against documents. Correspondence, Spanish. Reference No. 3757.

Zinc, copper and sulphate of ammonia—Italy. Agency and purchase desired. Quotations, c. i. f. Italian port. Payment, cash against documents. Reference No. 3758.

Corrugated sheets—India. Purchase desired. Quotations, c. i. f. Karachi. Terms, cash. Reference No. 3762.

Iron kegs or drums suitable for packing stiff and liquid paints. Kegs to hold 28, 56 and 112 pounds, and drums 3, 5 and 10 gallons (imperial measure), medium-quality goods—Wales. Purchase desired. Quotations, c. i. f. Swansea or Bristol Channel port. Reference No. 3764.

Glazers' lead for vitrifying drainage pipes—Cuba. Purchase desired. Quotations, c. i. f. Caibarien. Terms, cash against draft. Correspondence, Spanish. Reference No. 3774.

Trade Catalogs

Baker Air Units. The Baker-Hansen Manufacturing Co., 1900 Park St., Alameda, Calif. This company has just issued a circular, known as Bulletin No. 201 in which is described in a comprehensive way, the Baker ball-bearing two-stage air units for oil stations, garages, tire shops, machine shops, and paint spraying machines. The publication contains illustrations of the unit with full illustrations as to its operation and maintenance.

The Tilted Turret. The Wood Turret Machine Co., Brazil, Ind. This company has just issued an instructive pamphlet on the subject of the tilted turret. The publication takes the form of questions and answers in which the many advantages of this type of turret are set forth in a clear and concise manner. Questions with their answers are also given on the precision index, the turret lock mechanism, the turret slide and saddle, spindle and bearings and automatic chuck and feed.

Portable Electric Drills. The A. F. Way Co., Inc., Hartford, Conn. This company has recently issued a new folder describing their portable electric drills. The publication contains illustrations showing construction features and a full description of the product.

Line Shafting Equipment. The Medart Co., St. Louis, Mo. This company has just issued a new condensed catalog of 192 pages with a complete index. The publication is made up in an attractive manner with numerous illustrations and line drawings and presents facts about the most generally used line shafting equipment. The aim has been to state dimensions, construction details and list prices in a way to enable engineers and designers, mechanics and power users—to plan installations and purchase the necessary requirements. The catalog forms a useful handbook with its many useful tables and is noteworthy in that no attempt is made in its pages to exploit the Medart products.

Pamphlets Received

Industrial Conditions in China. Trade Information Bulletin No. 61, prepared by the Far Eastern Division, Department of Commerce, on the present state of industrial conditions within the Chinese Empire. Distributed by the Department of Commerce, Washington, D. C.

Plan for Industrial Development of Szechwan Province, China. Trade information bulletin No. 62, prepared by the Far Eastern Division, Department of Commerce, on the state of conditions in the Chinese province of Szechwan. Distributed by the Department of Commerce, Washington, D. C.

International Association of Industrial Accident Boards and Commissions. Proceedings of the eighth annual meeting of the association, held in Chicago, September 19 to 23. This publication is known as Bulletin No. 304 of the U. S. Dept. of Labor, Bureau of Labor Statistics, from which department copies may be secured.

Foreign Trade of the United States. Trade information Bulletin No. 59 of the Department of Commerce. The bulletin is a review of the U. S. foreign trade for the fiscal year, 1921-1922. Distributed by the Department of Commerce, Washington, D. C.

Training for Foreign Service. Bulletin No. 27 of the Bureau of Education, Department of the Interior. This useful and valuable publication has been compiled by Glen Levin Swiggett and is divided into four parts as follows: Part 1, Economics; Part 2, Government; Part 3, Modern Foreign Languages and Part 4, Periodical Literature. Under each part are found numerous chapters on special phases of the subjects. Of particular value are the bibliographies to be found in the book furnishing a guide to the best works on the entire aspect of foreign service and the training therefor.

Notes on the Efficiency of Various Systems of Air Conditioning in a Munition Factory. U. S. Public Haelth Service, Treasury Department, Reprint No. 729. This pamphlet has been prepared by C. E. A. Winslow, professor of Public Health, Yale School of Medicine and Leonard Greenburg, assistant sanitary engineer of the U. S. Public Health Service.

Statistical Record of the British Iron and Steel Industry. Trade information bulletin No. 66 of the Iron and Steel Division of the Department of Commerce. The bulletin contains numerous statistical tables on the state of the industry which are of considerable interest at the present time. Distributed by the Department of Commerce, Washington, D. C.

Engineering Education After The War. By Arthur M. Greene, Jr., of Rensselaer Polytechnic Institute, Troy, N. Y. This publication is known as Bulletin No. 50, Department of Interior, Bureau of Education, and contains a review of engineering study courses with changes made therein during and since the late world war.

Forthcoming Meetings

American Mining Congress, twenty-fifth annual convention, new auditorium, Cleveland, Ohio, October 9 to 14. Secretary, J. F. Callbreath, 84 Munsey Building, Washington, D. C.

Second National Aero Congress and National Airplane Races, Detroit, Mich., October 7 to 14, 1922.

American Gear Manufacturers' Association. Fall meeting, Chicago, Ill., Oct. 9, 10 and 11, 1922.

Automobile Accessories Branch of the National Hardware Association of the United States. Convention and Exhibition, Atlantic City, N. J., Oct. 13, 17, 1922. Headquarters, Hotel Ambassador, T. James Fernley, secretary-treasurer, 505 Arch St., Philadelphia, Pa.

National Hardware Association of the United States. Convention, Atlantic City, N. J. Oct. 17, 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. T. James Fernley, secretary-treasurer, 505 Arch Street, Philadelphia, Pa.

American Hardware Manufacturers' Association. Convention, Atlantic City, N. J., Oct. 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York.

National Association of Farm Equipment Manufacturers. Annual Convention, October 18 to 20, Congress Hotel, Chicago.

Society of Industrial Engineers. Oct. 18 to 20. McAlpin Hotel, New York. Secretary, George C. Dent, 327 South LaSalle St., Chicago.

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances.—Bulk of steel buying being done by railroads; 113,000 cars purchased thus far this year as against 28,000, last year. Shapes, plates and bars, $2@$2.25 f.o.b. Pittsburgh, on ordinary business, for indefinite deliveries; $2.50 per 100 lb. on plates, however, where deliveries are specified at earliest possible time consistent with rail embargoes, now holding up all but food and fuel shipments. Connellsville foundry coke up 50c. per ton.

Tin, 33c. as against 32⅞c. per lb. at New York warehouses. Lead, 6¼c. as compared with 6.15c., f.o.b. East St. Louis, last week. Aluminum ingots up ½c. per lb. in New York.

Raw linseed oil, 93c. as against 91c. per gal. (5 bbl. lots) f.o.b. New York. Market firmer; tendency upward with continued scarcity of spot oil. Lard oil market stronger; prices unchanged.

Declines—Pig-iron showing downward tendency despite higher coke prices, with increased production and falling off in demand.

Zinc, 6.7c. as against 6.86c.@6.9c. per lb., East St. Louis; 7⅝c. as compared with 7½c. at New York warehouses.

Lubricating oils show sluggish market, with large stocks on hand.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.55
Northern Basic	32.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	28.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	36.64
Virginia No. 2	37.17
Basic	32.00
Grey Forge	32.00
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	35.00
Basic	33.00
Bessemer	33.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cincinnati	8.0	6 0	5@5½
Cleveland	8.0	5.25	4.5
Chicago	6.0	5.0	4.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 50@2.75	4.19	3.70	4.00
No. 12	2.60@2.85	4.24	3.75	4.05
No. 14	2.70@2.90	4.29	3.80	4.10
No. 16	2.90@3.20	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.60	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.65	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.70	4.80	4.30	4.75
No. 28	3.35@3.75	4.90	4.40	4.85
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11.	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.15	5.30	4.80	....
Nos. 22 and 24.	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.10	5.55
No. 28	4.35@4.75	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	34	19
LAP WELD					
2	61	49½	2	29	15
2½ to 6	65	53½	2½ to 4	32½	19
7 to 8	62	49½	4½ to 6	32½	19
9 to 12	61	48½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	34	20
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	30	17
2½ to 4	63	52½	2½ to 4	33	21
4½ to 6	62	51½	4½ to 6	32	20
7 to 8	58	45½	7 to 8	25	13
9 to 12	52	39½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded.	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	2.92½
Soft steel bars (base)	3.04	2.91	2.82½
Soft steel bar shapes (base)	3.04	2.91	2.82½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	2.92½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
⅛	6.50		11@12
$\frac{5}{32}$ to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.75
Tin, 5-ton lots, New York	33.00
Lead (up to carlots), St. Louis.... 6.25; New York.	6.75@.6.87½
Zinc (up to carlots), St. Louis..... 6.70; New York.	7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	21.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.00	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.25	10.25	.....
Solder (½ and ½), (caselots)	25.00	23.50	20.00
Babbitt metal (83% tin)	34.00	42.25	36.00
Babbitt metal (35% tin)	25.00	16.00	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	12.00	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3.00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11¼
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13¼x13¼, per lb.	.075	.06	.10
Wiping cloths, 13¼x20½, per lb.	.08	.096	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 12.75	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00

Coke, prompt furnace, Connellsville... per net ton 11.[illegible]@12.50
Coke, prompt foundry, Connellsville... per net ton 13.50@14.50

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ¾ in. per 100 lb. (net)	4.50	5.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.35
Cone heads, ditto (net)	5.10	4.00	3.45
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	60-10-5%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Hamler Boiler Tank Co., 6025 West 66th St., one horizontal pyramid type plate bending roll, 12 ft. between housings, drop housings with power lift, 1 in. plate capacity, arranged for motor drive; also similar machine, 16 ft. between housings.

Ill., Chicago—J. Hess, 1219 South Western Ave., (machine shop)—one double crank geared blanking press.

Ind., Indianapolis—Indiana Battery Service Co., 1007 North Meridian St., H. Churchman, Pres.—electrical machinery, tools and equipment for 1 story service and repair shop for electrical automobiles and automotive equipment.

Ind., Michigan City—The Super Range Co., R. L. Poe, Purch. Agt.—machine tools and foundry equipment for the manufacture of stoves and ranges.

Ia., Ottumwa—Hardsoeg Mfg. Co. (manufacturer of mining tools)—one press for forging pick eyes, about 60 in. between uprights, die space approximately 20 x 60 in., distance between slide and bed with stroke down and adjustment up, 20 in., stroke 6 to 8 in., diameter crank 8 in., press shearing attachment preferred.

Md., Baltimore — Beckerly-Trusler Co., 306 Stewart Bldg.—one 20 in. metal lathe.

Mich., Detroit—Base-O-Lite Products Co., 114 Woodbridge St., E.—bench, tap and drill, motor driven, vertical and reversible.

Mo., St. Louis — The Modern Specialty Co., 8 North 16th St. (machine shop)—spring making machinery and spring winding machine, power equipment.

N. Y., New York—McCall Co., 236 West 37th St., (publishing plant) A. Dudley, Purch. Agt.—one 24 x 12 in. engine lathe, 9 ft. between centers.

O., Cleveland—Star Machine & Tool Co., 433 Champlain St.—one small punch press.

O., Columbus—Columbus Auto Parts Co., 215 East Russell St., R. E. Klages, Pres.—automatic milling machine and screw machine.

O., Columbus—Jaeger Machine Co., 520 Dublin Ave. (manufacturer of machines and concrete mixers), G. Jaeger, Pres.—one 30 in. vertical boring machine and one 21 or 24 in. turret lathe.

O., Uhrichsville—Gallagher Bros.—additional machine shop equipment.

Pa., Palmerton — Horlachers Garage — machine and repair shop equipment for new garage.

Pa., Pittsburgh—The Fairmont Creamery Co., 301 Ferry St.—garage and repair shop equipment, also mechanical equipment for proposed $150,000 garage and warehouse on 26th and Smallman Sts.

R. I., Providence—The Hope St. Garage Co., 825 Hope St.—machinery and equipment for proposed garage and service station.

Tenn., Chattanooga — Hamilton Mchy. Co., 204-208 Market St.—one 72 in. open side planer, having 12 to 16 ft. bed, (used).

W. Va., Wheeling—Centre Fdry. & Machine Co., 2011 Main St.—foundry and machine shop equipment.

Wis., Appleton—P. Rademacher, 801 Superior St.—automobile repair machinery for proposed garage.

Wis., Colby—Colby Buick Co., H. J. Cornelius, Mgr.—automobile repair machinery for proposed garage.

Wis., Eau Claire—W. A. Craig, 410 Galloway St.—automobile repair machinery.

Wis., Janesville—The Bower City Machine Co., 759 McKey Blvd.—machinery and equipment for proposed machine shop.

Wis., Marinette—C. Anderson & Son, Cook and Merryman Sts. (manufacturer of brick conveyors)—additional machine tools for proposed factory and machine shop.

Wis., Milwaukee—The Radio Garage, Inc., c/o K. Fleming, 473 12th St.—repair shop machinery, including lathe, etc.

Wis., Milwaukee—The Uecke Motor Car Co., c/o E. Uecke, 1412 9th St.—repair shop equipment including drill press.

Wis., Slinger — L. A. Burg—automobile repair machinery for proposed garage.

Wis., West Bend—Amer. Service Garage Co., M. A. Johannes, Mgr.—automobile repair machinery.

Ont., Delhi—J. E. Stedelbauer—complete equipment for proposed garage and automobile repair shop.

Ont., Petrolea—Peninsular Sugar Co.—complete machine shop equipment.

Ont., St. Thomas—Lorne Tractors, Ltd., H. Carmichael, Mgr.—tools and metal working equipment for plant at Tillsonburg.

Que., Montreal—J. Linssen, 600 Dorchester St., W.—one 12 in. engine lathe and one swing and drill press.

Machinery Wanted

Ark., Mountain Home—W. Wolf—machinery and equipment for proposed cold storage and refrigeration plant.

Conn., Middletown—Burns Lace Mfg. Co.—two 54 x 60 in. extractors and two starch mangles.

Ga., Atlanta—Hightower Box and Tank Co., T. H. Trent, 40 Queen St., Secy.—special machines for the manufacture of bottle boxes and other lock corner boxes; also other general woodworking machines, total cost $30,000.

Ga., Gainesville—W. Taffar—machinery and equipment for show case manufacturing plant at Athens.

Ill., Chicago—E. M. Heller & Co., 144 West Kinzie St.—hydraulic lard press, meat cutter, copper kettles and belting.

Ill., Chicago—Western Newspaper Union, 210 South Desplaines St.—one Cox duplex, 8 page printing press.

Ill., Joliet—J. Argo, 405 Grant Ave. (iron company)—compressor and pressure tank.

Ind., Logansport—The Universal Burner Co. (manufacturer of liquid fuel burning equipment)—air compressors and steam pumps.

Ind., Plymouth—Bd. Educ.—vocational equipment for proposed high school.

Ky., Louisville—Axton-Fisher Co., 811 South 20th St.—machinery and equipment for proposed addition to tobacco factory.

Ky., Louisville—R. C. Wayne Supply Co., 608 West Jefferson St.—one 20 ton, 8 wheel locomotive crane with reversible engine.

Md., Salisbury—Salisbury Ice Co., J. Price, Pres.—machinery and equipment for 6,000 ton ice handling plant.

Mass., Boston—Advance Printing Service Co., 78 Portland St.—hand press, card cutter, also lever pipe cutter (used).

Mass., Boston—The Amer. Net & Twine Co., 575 Atlantic Ave.—machinery for proposed factory at West Kennebunk, Me.

Mass., Cambridge—American Oil Co. (oil refiners)—used rubber mill and vulcanizing press for experimental purposes.

Mass., Malden—G. O. Smith—knitting machines for the manufacture of men's neckties.

Mass., Ware—Ware River News—remelting furnace, about 300 lbs., ingot molds.

Mich., Detroit—The Gray Motor Co., Mack Ave.—miscellaneous equipment for manufacturing and assembling automobiles.

Mich., Laingsburg—Press (newspaper)—linotype.

Mo., Kansas City—C. P. Shipley, 1627 Genesee St. (machine shop)—air compressor and a Deming duplex power pump for oil burner.

N. J., Newark—Kreuter & Co., 563 18th Ave. (machinists)—exhauster having 16 in. inlet.

N. J., Newark—The Newark Umbrella Frame Co., 359 Ogden Ave.—automatic machine for the manufacture of 7 and 8 notch umbrella parts.

N. Y., Buffalo—Buffalo Pattern Wks., 1445-1447 Niagara St.—machinery and equipment for pattern works to replace that which was destroyed by fire.

N. Y., Buffalo—C. J. Heimerle, 37 Orange St.—machinery for light manufacturing and for the manufacture of automobile parts.

N. Y., Buffalo—King Electric Mfg. Co., 1681 Fillmore Ave.—one 25 cycle, 110 volt, not less than 5 kw. spot welder.

N. Y., Buffalo—A. Leising, 19 Greenfield St.—bakeshop equipment.

N. Y., Buffalo—M. E. Lamkin, 586 Masten St.—equipment for tinsmith shop.

N. Y., Buffalo—G. V. Patrick, 514 Elmwood Ave.—equipment for proposed wholesale and retail bakery.

N. Y., Buffalo—W. A. Schneggenberger, 212 Hertel Ave.—cutting machinery and equipment for proposed junk and iron metal scrap plant.

N. Y., Gouverneur—Aldrich Paper Co., N. R. Caswell, Pres.—machinery and equipment for proposed $40,000 addition to paper factory.

N. Y., Jamestown—The Alliance Furniture Co., 615 Allen St.—machinery and equipment for proposed addition to factory.

N. Y., Jamestown — Jamestown Lounge Co., 40 Winsor St.—machinery and equipment for proposed addition to factory.

N. Y., Jamestown—Liberty Upholstery Co., Inc., Martyn Bldg., F. R. Nelson, 6 Seneca St., Pres.—woodworking machinery and equipment for the manufacture of living room furniture.

N. Y., New York—J. C. Bossong Co., 88 Franklin St. (manufacturer of hosiery)—several Scott and Williams machines, 176-200-220 needle gauge.

N. Y., New York—Hickman Mfg. Co., 70 Cortlandt St., A. W. Bell, Purch. Agt.—small stone crusher and road scraper.

N. Y., Rochester—A. T. Crapsey Co., Atlas Bldg., Elm St., E. G. Starry, Secy. and Treas.—machinery and equipment for proposed addition to clothing manufacturing plant.

N. Y., Syracuse—The United States Hoffman Mchy. Co., 729 Temple St. (manufacturer of clothes pressing machines, etc.)—complete machinery and equipment for addition to factory.

N. Y., Tonawanda—National Roofing Co., Fillmore St.—machinery and equipment for proposed $250,000 plant, for the manufacture of roofing at Chattanooga, Tenn.

N. C., Marion—Marion Knitting Mills—sixty 176 needle Scott & Williams knitting machines, models B-3 or B-5.

O., Asheville—Asheville Fireproof Co., J. Dum, Pres.—machinery and equipment for proposed plant for the manufacture of hollow tile and brick.

O., Cleveland—Lyons Bros., 983 East 152nd St.—power hammer, 300 or 400 lb. capacity, (used).

O., Cleveland — Western Newspaper Union, 1279 West 3rd St.—one 10 x 15 in. and one 12 x 18 in. job press, also paper cutter for power equipment.

O., Columbus—Grumman & Moyer Co., 286 South Greenwood Ave. (manufacturer of furniture, boxes, crates, etc.) — wood working machinery, saws, planers and shapers.

O., Columbus—O. Harmon, 523 Carpenter St., (printer)—8 x 12 in. and 10 x 15 in. printing press, 22 in. paper cutter for power equipment.

O., Columbus—Weinman Pump Mfg. Co., 284 Spruce St., W. N. Weinman, Pres.—machinery for addition to plant (new).

O., Fremont—Fremont Metal Body Co.—machinery and equipment for proposed factory, for the manufacture of metal automobile bodies, etc.

O., Lima—Vapo Stove Co.—machinery and equipment for proposed stove factory.

O., Ravenna—F. H. Phillips & associates, c/o Chamber of Commerce—machinery and equipment for automobile body plant.

O., Warren—Clark Knitting Co., 37 Walnut St., E. E. Clark, Secy. and Gen. Mgr.—machinery for hosiery knitting mill.

Okla., Bartlesville—Black, Sivalls & Bryson, Inc., J. A. Sivalls, Secy.—machinery and equipment for proposed addition to tank erecting shop in Rocky Mountain section.

Okla., Henryetta—O'Neil Petroleum Co., Box 548—pumping power outfit suitable for pumping number of wells on a 40 acre site.

Pa., Bath—Bd. of Educ.—vocational equipment for proposed school.

Pa., East Smethport—Smethport Aceton Co.—machinery and equipment for acid chemical works, to replace that which was destroyed by fire and explosion.

Pa., Natrona — School Districts of the Boro. of Brackenridge, and Twp. of Harrison, c/o F. M. Hathaway, 54 Garfield St.—equipment for manual training department.

Pa., Packerton—Packer Silk Mills—machinery and equipment for branch silk factory at Leighton.

Pa., Pittsburgh—Jones & Laughlin Steel Co., 3rd Ave. and Ross St.—one 50 ton crane with 10 ton auxiliary, for power house, Eliza furnace, two 5 ton and one 15 ton cranes for South Side Wks.; cranes, ladles and other equipment for Aliquippa Wks.

Pa., Pittsburgh — Meyers Printing Co., 6309 Broad St.—saw trimmer and other printing equipment.

Pa., Pittsburgh—Open-Hearth Fire Brick Co., 1407 Keenan Bldg. (manufacturer of sleeves, runners, nozzles, runner brick and silicia brick), H. O. Williams, Purch. Agt.—machinery and equipment for plant at Freeport.

Pa., Pittsburgh—The Union R.R. Co., Carnegie Bldg.—600 ton wheel press.

Pa., Pittston—Hillside Coal & Iron Co.—special machinery for equipping new coal colliery with wet jig process of separating coal and slate.

Pa., Reading—The Reading Rubber Co.—$20,000 worth of machinery and equipment for tire and rubber plant at Kutztown.

S. C., Rock Hill—The Anderson Motor Co.—two Rabbit No. 4 planers.

Tenn., Maryville—Ideal Hosiery Mills—several 220 needle, 3½ cylinder Banner machines, also ribbers and loopers.

Tex., Deweyville—Peavy-Moore Lumber Co.—sawmill machinery and power house equipment.

Tex., Winfield—Lignite Coal Co.—second motion hoisting engine, with a 10 x 12 cylinder.

Va., Lynchburg—C. M. Guggenheimer (newspaper publisher)—one 12 x 18 in. Gordon press.

Va., Richmond—News-Leader Publishing Co. (newspaper)—2 super special Howe printing presses and 15 linotype machines.

Va., Richmond—Richmond, Fredericksburg & Potomac R.R., Union Sta., R. J. Rouse, Purch. Agt.—washout system for coaling plant, requiring pump and tanks, also complete outfit for blacksmith shop, including forges, air compressors, engine boiler, drill and lathe.

W. Va., New Martinsville — Universal Concrete Products Co.—air compressor.

Wis., Appleton—Traas Candy Co., 865 College Ave.—candy making machinery and equipment.

Wis., Green Bay—Fort Howard Paper Co., South State St.—special paper finishing machinery.

Wis., La Crosse—E. D. Hunt, 909 State St.—laundry machinery.

Wis., Marinette—C. Anderson & Sons, Cook and Merryman Sts.—special tools, power machinery and machines for the manufacture of brick conveyors.

Wis., Milwaukee—Ideal Shoe Mfg. Co., 1115 4th St., C. Ortgiesen, Purch. Agt.—shoe working machinery, individual motors.

Wis., Milwaukee—O. J. Koch Co., 2825 Grand Ave.—machinery for candy making.

Wis., Milwaukee—F. Kraning, 1147 Forest Home Ave.—gas storage tanks and pump for proposed addition to garage.

Wis., Milwaukee—I. Lecy, 946 26th Ave., (woodworker)—medium sized planer.

Wis., Neenah—The Valley Paper Mills, 145 West Wisconsin Ave.—machinery for proposed paper mill.

Ont., Brantford—The city, F. P. Adams, City Engr.—concrete mixer and material unloading equipment.

Ont., Burford—Burford Knitting Mills, W. Burgess, Mgr.—special knitting mill equipment for proposed plant at Simcoe.

Ont., Hanover—The Peninsular Cord Tire Co., W. A. Oakley, Mgr.—special tire and rubber manufacturing equipment.

Ont., Night Hawk Lake (Timmins P. O.) The Peninsular Mines—equipment for 200 ton mill (gold mining).

Ont., Tavistock—Ratz & Sons—machinery and equipment for flour mills, to replace that which was destroyed by fire.

Que., Montreal—J. A. Ritchie & Co., 140 Clarke St., A. James, Purch. Agt.—pulverizer, high speed, for grinding.

Mex., Tampico—Mexican Petroleum Co.—machinery and equipment for gasoline manufacturing plants in the Cerro Azul and Chapopote petroleum fields.

Metal Working Shops

Calif., Oakland—A. Kahn, Archt., 1000 Marquette Bldg., Detroit, Mich., is receiving bids for the construction of a 2 story, 80 x 684 ft. factory, on Hillside Ave. and 72nd St., here, for the Chevrolet Automobile Co., Foothill Blvd. and 69th Ave. Estimated cost $250,000. Noted Sept. 28.

Calif., San Francisco—The Bothin Real Estate Co., 604 Mission St., awarded the contract for the construction of a 3 story garage on Natoma, Hunter and Sherwood Sts. Estimated cost $45,000. Noted Sept. 14.

Calif., San Francisco — The Brumfield Electric Sign Co., 18 7th St., awarded the contract for the construction of a 1 story, 75 x 85 ft. and 25' x 80 ft. electric sign manufacturing plant, on Folsom St. near 6th St. Estimated cost $12,000. Noted May 18.

Calif., San Francisco—Crest View Apartments, Inc., c/o J. L. Stewart, Archt., Claus Spreckels Bldg., is having preliminary plans prepared for the construction of a 1 story garage on Washington St., near Gough St.

Calif., San Francisco—L. Skerl, 298 11th St., will build a 2 story factory for heavy sheet metal work, on Folsom St. near 11th St. Estimated cost $5,000. Private plans.

Calif., Watsonville — Watsonville High School District has had preliminary plans prepared for the construction of a machine shop building on the high school grounds. Wyckoff & White, Growers Bank Bldg., San Jose, Archts.

Conn., Norwalk—Meeker Union Fdry., 34 Smith St., awarded the contract for the construction of a 1 story addition to its plant. Estimated cost $10,000. Noted July 6.

Ill., Chicago—F. G. Arnold Co., c/o Z. E. Smith, Archt., 304 East 55th St., awarded the contract for the construction of a 1 story, 75 x 160 ft. garage at 3725-29 Ogden Ave. Estimated cost $50,000.

Ill., Chicago—F. Gustafson, 5724 Kenmore Ave., awarded the contract for the construction of a 1 story, 109 x 200 ft. garage, at 405-423 East Erie St. Estimated cost $80,000.

Ill., Chicago—The Pullman Co., 101st St. and Corliss Ave., awarded the contract for the construction of a 1 story, 200 x 250 ft. foundry addition. Estimated cost $600,000.

Ill., Oak Park—Davis & Kramer, Archts., 400 North Michigan Ave., Chicago, are receiving bids for the construction of a 1 story, 100 x 122 ft. garage, on Madison St. and East Ave., here, for J. F. Stacey, c/o architects. Estimated cost $50,000.

Ind., Evansville — The Fellwock Motor Co., 3 U 4th St., is having plans prepared for the construction of a 2 story service station. Estimated cost $60,000. C. Shopbell, Furniture Bldg., Archt.

Ind., Fort Wayne—The General Electric Co., Bway. and Wall St., plans to build a 1 story, 100 x 150 ft. tank shop and garage. Estimated cost $30,000. Private plans.

Ind., Indianapolis—The Indiana Battery Service Co., 1007 North Meridian St., awarded the contract for the construction of a 1 story, 60 x 200 ft. automobile service station. Estimated cost $30,000. Noted Oct. 5.

Ind., Indianapolis—The Rockwood Mfg. Co., 1801 English Ave., awarded the contract for the construction of a 1 story, 75 x 100 ft. machine shop. Estimated cost $40,000. Noted Oct. 5.

Ind., Richmond—The Automotive Gear Co. will build a 1 story, 400 x 600 ft. gear factory. Estimated cost $35,000. Noted Sept. 7

Mass., Springfield—G. H. Chaplin, 374 Main St., awarded the contract for the construction of a 3 story, 80 x 120 ft. garage on Harrison Ave. Estimated cost $100,000.

Mass., Worcester—The Home Accessories Corp., Gardner and Tainter Sts., will soon award the contract for the construction of a 2 story, 45 x 112 ft. addition to its factory, for the manufacture of bath room fixtures. Estimated cost $35,000. Private plans.

Mich., Dearborn—A. Kahn, Archt., 1000 Marquette Bldg., Detroit, will soon award the contract for the construction of a 1 story, 202 x 804 ft. and a 2 story, 51 x 235 ft. engineering laboratory, on Oakwood Blvd., here, for Ford Motor Co., Highland Park. Estimated cost $250,000. Noted Oct. 5.

Mich., Detroit—Gray Motor Co., Mack Ave. and Railroad St., awarded the contract for the construction of a 1 story, 200 x 550 ft. automobile factory. Estimated cost $200,000.

Mich., Detroit—The Maxwell Motor Co., 12200 East Jefferson St., awarded the contract for the construction of a 1 story, 80 x 440 ft. factory. Estimated cost $200,000.

Minn., Minneapolis—T. R. McKenzie, 1050 Plymouth Bldg., has had plans prepared and will soon receive bids for the construction of a 1 story, 154 x 164 ft. garage and store building, at 2628 Hennepin Ave. Estimated cost $50,000. P. O. Moe, 1037 Plymouth Bldg., Archt.

N. J., Trenton—The Mercer County Board of Freeholders awarded the contract for the construction of a 2 story garage and warehouse. Estimated cost $31,000. Noted Sept. 21.

N. Y., Brooklyn — The Court Heights Realty Co., c/o J. Lubroth, Archt., 44 Court St., awarded the contract for the construction of a 2 story, 55 x 205 ft. garage at 22 Concord St. Estimated cost $75,000.

N. Y., Jamestown—The Watson Mfg. Co., 63 Taylor St., manufacturer of window and door screens, awarded the contract for the construction of a 4 story addition to its factory. Estimated cost $25,000. Noted Aug. 29.

N. Y., Mount Kisco—The Westchester Lighting Co., 1st Ave., Mount Vernon, awarded the contract for the construction of a 1 story automobile service and repair building, here. Estimated cost $50,000.

N. Y., Tonawanda—The National Roofing Co. plans to rebuild portion of its factory which was recently destroyed by fire. Estimated cost $5,000. Architect not announced.

N. Y., White Plains—The New York Telephone Co., 15 Dey St., New York City, is having plans prepared for the construction of a 2 story, 155 x 205 ft. automobile service and repair building, on White Plains Rd., here. Estimated cost $200,000. McKenzie, Voorhees & Gmelin, 342 Madison Ave., New York City, Engrs. and Archts.

Pa., Phila.—T. Bardaro, 57 East Vine St., will soon receive bids for the construction of a 2 story, 32 x 90 ft. and 18 x 24 ft. garage, at 5611 Vine St. Estimated cost $50,000. F. N. Greisler, 1035 Walnut St., Archt.

Pa., Phila.—Osmond & Keene, 1619 Sansom St., awarded the contract for the construction of a 1 story, 89 x 125 ft. and 25 x 29 ft. garage, on Greene St. and Queen Lane. Estimated cost $70,000.

Pa., Pittsburgh—The Equitable Gas Co., Phila. Co. Bldg., awarded the contract for the construction of a 1 story, 50 x 164 ft., 50 x 140 ft. and 15 x 20 ft. repair and machine shop on Reedsdale St.

Pa., Pittsburgh—Hubbard & Co., Granite Bldg., manufacturer of shovels, is having plans prepared for the construction of a 1 story addition to its plant on 63rd and Butler Sts. Private plans.

Pa., Pittsburgh—The Neely Nut & Bolt Co., 26 South 22nd St., is having plans prepared for the construction of a 1 story, 120 x 150 x 173 x 210 ft. addition to its plant. Private plans.

Pa., Pittsburgh—The Stroh Steel Hardening Process Co., Westinghouse Bldg., will build a 1 story, 68 x 100 ft. steel foundry and machine shop on Chateau and Ridge Sts. Estimated cost $250,000. V. S. Cruze, c/o owner, Engr. Noted Sept. 7.

Pa., Sharpsburg—L. Z. Hodil, 88 Bridge St., awarded the contract for the construction of a 1 story, 95 x 140 ft. garage, on Main St. Estimated cost $40,000.

R. I., Providence—The Hope St. Garage Co., Inc., 825 Hope St., awarded the contract for the construction of a 1 story garage and service station on 4th and Hope Sts. Estimated cots $50,000. Noted Sept. 21.

Tex., Dallas—The Southern Wire & Iron Mfg. Co., Harwood and Santa Fe Sts., plans to build a wire factory, consisting of 4 units. Cost will exceed $50,000. Architect not announced.

W. Va., Clarksburg — The Carmichael Motor Co. is having preliminary plans prepared for the construction of a 2 story, 83 x 126 ft. garage on 6th St. Estimated cost $65,000. E. J. Wood & Son, Lowndes Bldg., Archts.

W. Va., Weirton—The Weirton Steel Co. awarded the contract for the construction of eight 1 and 2 story steel sheet mills. Estimated cost $1,500,000.

Wis., Janesville—The Bower City Machine Co., 759 McKey Blvd., awarded the contract for the construction of a 1 story, 50 x 90 ft. machine shop. Estimated cost $40,000.

Wis., Marinette — C. Anderson & Son, Cook and Merryman Sts., manufacturer of brick conveyors, will build a 2 story, 36 x 75 ft. factory and machine shop, on Main St. Estimated cost $10,000. Private plans.

Wis., Milwaukee—A. G. Wolff, Archt., 453 Mitchell St., is receiving bids for the construction of a 2 story, 40 x 80 ft. addition to garage, for F. Kraning, 1147 Forest Home Ave. Estimated cost $40,000.

Wis., New Diggings—The Imperial Mining Co. will build a 2 story, 75 x 190 ft. zinc mill.

Wis., Slinger—L. A. Burg is receiving bids for the construction of a 1 story, 60 x 90 ft. garage. Estimated cost $40,000. Private plans.

Ont., Delhi—J. E. Stedelbauer plans to rebuild his garage and automobile repair shop which was destroyed by fire. Estimated cost $40,000.

Ont., Niagara Falls — Davidson & Williams, Chippewa, awarded the contract for the construction of a 2 story, 40 x 100 ft. garage. Estimated cost $25,000. Noted Sept. 21.

General Manufacturing

Ariz., Phoenix—The Southwest Portland Cement Co., 356 South Spring St., Los Angeles, is having plans prepared for the construction of a cement plant, here. Estimated cost $1,500,000. Private plans.

Colo., Denver—The Denver Custom Garment Co., 1517 Lawrence St., is having plans prepared for the construction of a 2 story, 60 x 125 ft. office and factory building. Estimated cost $75,000. H. W. J. Edebrook, Colorado Theatre Bldg., Archt.

Ill., Chicago—A. S. Alschuler, Archt., 28 East Jackson Blvd., is receiving bids for the construction of a 4 story furniture factory, on George St. near Crawford St., for the Valentine-Seaver Co. Estimated cost $400,000. Noted Sept. 14.

Ill., Chicago—Olson Rug Co., 32 Laflin St., is having plans prepared for the construction of a 5 story, 84 x 187 ft. factory. Davidson & Weiss, 53 West Jackson Blvd., Archts.

Ill., Chicago—The Purity Packing Co., 3247 West 47th St., awarded the contract for the construction of a 2 story, 100 x 125 ft. canning factory. Estimated cost $100,000.

Ind., Elkhart—The Curtain Supply Co. is having plans prepared for the construction of a 1 story, 172 x 400 ft. curtain factory. Estimated cost $100,000. Muncie & Jenson, 38 South La Salle St., Chicago, Archts.

Ind., Ft. Wayne—The American Art Textile Co. plans to build a 2 story addition to its textile plant. Estimated cost $27,000. Architect not selected.

Ind., Fort Wayne—The Wayne Oil Tank & Pump Co., Anthony Hotel, is having plans prepared for the construction of a 1 story, 50 x 320 ft. paint factory. Estimated cost $40,000. Austin Co., 208 South La Salle St., Chicago, Archts.

Ind., Hammond — The Hammond Dairy Co. is receiving bids for the construction of a 2 story, 55 x 70 x 153 ft. creamery at 680 Oakley Ave. Estimated cost $100,000. A. C. Berry & Co., Ruff Bldg., Archts. Noted Oct. 5.

Ind., Hammond—The Hydrox Co., 24th St. and Lake Park Ave., Chicago, is having plans prepared for the construction of a 3 story ice cream plant on Hohman St., here. Estimated cost $100,000. The McCormick Co., Inc., Century Bldg., Pittsburgh, Pa., Archts.

Ind., Hammond—H. J. Postlewaite, c/o M. Turner, Archt., 633 Hohman St., is receiving bids for the construction of a 2 story, 45 x 100 ft. printing plant. Estimated cost $25,000. Noted Sept. 14.

Ind., Indianapolis — Fra-Rose-Cleaners, 30th St. and Central Ave., are having plans prepared for the construction of a 2 story, 41 x 111 ft. cleaning plant. Estimated cost $25,000. T. A. Winterrowd, American Central Life Bldg., Archt.

Ind., Indianapolis—The United States Encaustic Tile Wks., 349 West 16th St., is having plans prepared for the construction of a 2 story, 90 x 100 ft. factory. Estimated cost $30,000. S. A. Hastings, c/o owner, Archt.

Ind., Jasper—The Hoosier Desk Co. is having plans prepared for the construction of a 3 story, 60 x 200 ft. addition to its furniture factory. Estimated cost $40,000. C. A. Shopbell, Furniture Bldg., Evansville, Archt.

Ind., South Bend—The Ward Baking Co., 5659 South La Salle St., Chicago, plans to build a 4 story bakery on South Main St., here. Estimated cost $175,000. Architect not selected.

Me., West Kennebunk—The Amer. Net & Twine Co., 575 Atlantic Ave., Boston, is building a 75 x 100 ft. factory, here.

Mass., Allston (Boston P. O.)—The Atlantic Refining Co., 248 Boylston St., Boston, awarded the contract for the construction of a 2 story, 100 x 200 ft. warehouse and plant on Cambridge St., here. Estimated cost $85,000.

Mass., Salem—Baker & Kimball, 38 South St., Boston, manufacturers of leather, will soon award the contract for the construction of a 3 story, 70 x 175 ft. factory, here. Estimated cost $50,000. Private plans.

Mich., Detroit—Dept. of Street Railways, Shoemaker and St. Jean Aves., plans to build a 1 story, paint shop, on Woodward Ave. Estimated cost $100,000. W. C. Markham, 312 Marquette Bldg., Engr.

Mich., Grand Rapids — Valley City Creamery Co., 666 Lake Dr. S. E., plans to build a 2 story, 40 x 100 ft. creamery. Estimated cost $40,000. H. L. Mead, Grand Rapids, Archt.

Minn., Minneapolis—The Lavoris Chemical Co., 52 Western Ave., is having plans prepared for the construction of a 3 story, 45 x 110 x 143 ft. office and factory building on 3rd St. and 10th Ave., N. Estimated cost $125,000. W. H. Levings, Secy. Long & Thorshov, 1028 Andrus Bldg., Archts.

N. Y., Buffalo—The Niagara Gas Corp., 179 Baraga St., plans to build an addition to its compressor plant. Estimated cost $5,000. Architect not announced.

N. Y., Geneva—The Lisk Mfg. Co., Canandaigua, awarded the contract for the construction of a 160 x 280 ft. enamel ware factory, here. Estimated cost $1,000,000. Noted Sept. 21.

N. Y., Jamestown—The Alliance Furniture Co., 615 Allen St., plans to build a 4 story addition to its factory, to contain 20,000 sq.ft. floor space. Cost will exceed $50,000. Architect not announced.

N. Y., Jamestown—The Empire Case Goods Co., 142 Foote Ave., plans to build a 2 story addition, containing 7,000 sq.ft. of floor space, to its dining room and bedroom furniture factory. Cost will exceed $25,000. Architect not announced.

N. Y., Jamestown—The Jamestown Chair Co., 20 Winsor St., awarded the contract for the construction of a 4 story, 50 x 67 ft. addition to its chair factory. Estimated cost $20,000. Noted Oct. 5.

N. Y., Jamestown — Jamestown Lounge Co., 40 Winsor St., plans to build a 6 story, 102 x 104 ft. addition to its factory. Architect not announced.

N. Y., Long Island City — The Perry Candy Co., 408 West Bway., New York City, awarded the contract for the construction of a factory on Wilbur Ave., here. Estimated cost $75,000. Noted Sept. 21.

N. Y., Randolph—A. and D. Harris, Penfield, plan to rebuild their apple evaporator plant, here, which was recently destroyed by fire. Estimated cost $7,500. Architect not announced.

N. C., Gastonia—Arkray Mills is building a 2 story, 136 x 471 ft. manufacturing plant, to house 20,000 spindles.

N. C., Gastonia — The Flint Mfg. Co., manufacturer of yarns, is building a 2 story, 136 x 385 ft. manufacturing plant, to house 1,200 spindles.

O., Cleveland—The Ferro Enameling Co., 4150 East 56th St., awarded the contract for the construction of a 2 story, 36 x 73 ft. addition to its factory. Estimated cost $25,000.

Pa., Bellefonte—G. Kelley, Port Matilda, R. D., plans to build an ice making plant, here. Estimated cost $18,000.

Pa., Castle Shannon—The Pittsburgh Art Stone Co., 807 Jones Law Bldg., Pittsburgh, is having plans prepared for the construction of a 1 story, 40 x 60 ft. manufacturing plant, here. Estimated cost $25,000. Private plans.

Pa., Jeannette — The American Window Glass Co., Farmers' Bank Bldg., Pittsburgh, awarded the contract for the construction of a 1 story addition to its glass plant, including machine tank buildings, furnace producer plant, boiler and power houses, and addition to cutting room. Estimated cost $1,500,000. Noted Sept. 14.

Pa., Phila.—The Manyunk Plush Co., 108 Levering St., awarded the contract for the construction of a textile factory on Gay and Main Sts. Estimated cost $20,000.

Pa., Phila.—C. Wunder, Archt., 1415 Locust St., will soon receive bids for the construction of a 5 story, 80 x 122 ft. paper factory, on 5th St. and Willow Ave., for Paper Mfg. Co., c/o F. A. O'Neil, 526 Cherry St. Estimated cost $200,000.

Pa., Pottstown—R. A. Reiff, 62 Hanover St., will soon receive bids for the construction of a 2 story, 60 x 190 ft. and 60 x 125 ft. knitting mill. Estimated cost $75,000. J. V. Pooley, 162 2nd Ave., Royersford, Archt.

Pa., Williamsport—The Demarest Silk Co., 607 Railway St., plans to build a 3 story addition to its silk mill. Estimated cost $100,000.

R. I., Pawtucket—J. and P. Coats, Inc., 366 Pine St., awarded the contract for the construction of an addition to its plant, consisting of two 2 and 3 story, 95 x 370 ft. and 95 x 270 ft. buildings, for the manufacture of thread. Estimated cost $400,000. Noted Oct. 5.

R. I., Pawtucket—The Prescott Corp., North Main and Bates Sts., awarded the contract for the construction of a 1 story, 75 x 120 ft. addition to its textile mill. Estimated cost $40,000.

Tenn., Knoxville — The Hall-Tate Co., North Gay St., plans to build a men's clothing factory and wholesale distribution building, 75 x 125 ft., on West Jackson Ave. Estimated cost $150,000. Architect not selected.

W. Va., Clarksburg—The Clarksburg Ice & Storage Co. plans to build a 1 story, 50 x 120 ft. ice plant. Estimated cost $50,000.

Wis., Clyman—The Reeseville Canning Co., Reeseville, plans to build a 3 story factory and warehouse, here. Private plans.

Wis., Milwaukee—A. C. Beck Co., 1 East St., plans to build a 2 or 3 story box factory, to replace one which was recently destroyed by fire. Architect not selected.

Wis., Neenah—The Valley Paper Mills, 145 West Wisconsin Ave., will soon receive bids for the construction of a 1 and 2 story, 80 x 627 ft. mill and a 112 x 144 ft. warehouse. E. A. Wettengel, 578 Pierce Ave., Appleton, Archt. Noted Sept. 29, 1921.

Wis., Stevens Point—Stevens Point Cleaning & Dye Wks., 446 Clark St., awarded the contract for the construction of a 1 story, 30 x 60 ft. cleaning and dyeing plant. Estimated cost $15,000.

Wis., Waukesha—Waukesha Lime & Stone Co. will build a 2 story, 50 x 120 ft. pulverizing plant, to replace the one which was destroyed by fire. Estimated cost $50,000. Private plans.

Wis., Wittenberg—The Holman Mfg. Co., 1910 North 13th St., Sheboygan, plans to build a 2 story, 60 x 95 ft. clothing factory, here. Estimated cost $50,000. H. Holman, Pres. Architect not selected.

B. C., Vancouver—The Seaman Paper Mills, 208 South La Salle St., Chicago, plan to build a paper mill here. Estimated cost $3,000,000. V. D. Simons, 39 South La Salle St., Chicago, Engr.

Ont., Niagara Falls—Dominion Canners, Ltd., c/o Chamber of Commerce, plans to build a large canning and packing factory on a five acre site. Cost will exceed $50,000.

Ont., Paris — Penmans, Ltd., manufacturer of woolen underwear, is having plans prepared for the construction of an addition to its factory. Estimated cost $50,000.

Que., Montreal, East—The Red Star Refineries Co., Ltd., Canada Cement Bldg., Montreal, plans to build a refinery, 1,000 bbl. per day capacity. Estimated cost $250,000.

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Design of Herringbone Gears

Methods of Cutting—Involute and Cycloidal Tooth Forms—Determination of Strength and Wear Factors—Care of Herringbone Gears

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THE rapid progress in the use of cut herringbone gears calls for more general information among mill engineers on the principles and practical points of their design. Nearly all writers on the subject, excepting the recent work of the Gear Manufacturers Association, have had a particular system or type of gear to advocate. This has resulted in a great deal of confusion and lack of general knowledge. Many times a gear has come to our attention which might have been produced much more cheaply if the designer had been familiar with the practice and methods for cutting such gears. It is the intention of this article to place such information before the reader in a clear, concise manner and to enlarge somewhat on theory.

To avoid confusion, let it be clearly understood that in its elements a herringbone gear is similar to a spur gear. Both have rolling action in the same plane, a plane normal to the axes of the gears; both have the same circumferential pitch for the same pitch diameter and the same number of teeth. A good tooth form for the spur gear is generally also a good tooth form for the herringbone gear, although, as will be shown later, the exact reproduction of the correct tooth curve is vastly more essential for the best operation of the herringbone gear.

In earlier days double or triple staggered spur gears were used, thereby obtaining a strong, heavy tooth with a comparatively smooth action. If this principle is now carried to its limit we obtain a helical gear. The

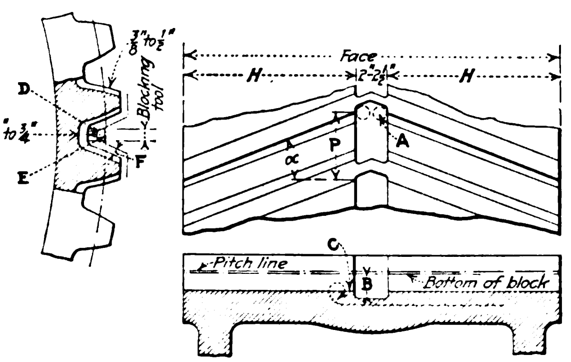


FIG. 1—DIAGRAM TO SHOW CLEARANCE POCKET IN PLANED GEAR

tooth profile on one side of the gear has been twisted ahead so as to occupy the former position of the tooth profile of the next tooth. Beyond this amount of twist nothing is gained so far as continuity of action is concerned. The herringbone gear is virtually two helical gears placed alongside each other, one having a right-hand helix and the other a left-hand helix.

In helical or herringbone gears it requires a right-hand helix to mesh with a left-hand helix. Therefore, if the ends of the pinion shaft or the hubs of the gear are not symmetrical, care must be exercised that the apex of the "V" be made in the proper direction. It

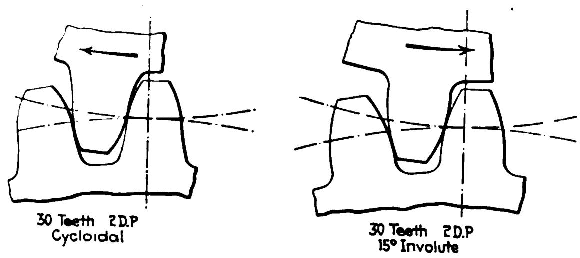


FIG. 2—OUTLINE OF INVOLUTE AND CYCLOIDAL TEETH

is customary to run molded herringbone gears with the apex of the "V" leading. This is not necessary with cut herringbone gears. They will run equally well in both directions but sometimes to prevent sideways splash of oil it is advantageous to run them in the opposite direction.

A knowledge of the different methods of cutting herringbone gears is essential, as that system of cutting or type of gear may then be selected which is the most economical for the case under consideration. Such gears are usually applied in the following cases:

I. Slow speeds and very heavy loads where strength and absence of shocks are of prime importance.
II. Smooth and noiseless operation.
III. Extremely high speeds.
IV. Very high gear ratios.

In the first class are all heavy rolling mill pinions. These may have up to 8 in. circular pitch. The smoother action resulting from the use of these pinions tends greatly to reduce breakage of all the machinery driven through them. The second class comprises nearly all cases of gear drives, such as mill drives, pump drives, mine hoist drives, and machine tool drives. In the latter application they are found to be a great aid in overcoming chatter in the machine. They have thus been applied particularly to planer drives. Spur gears become noisy at pitch speeds of 1,200 ft. per minute and should not be used at pitch speeds greater than 2,000 ft. per minute, if avoidable. The use of herringbone gears will then be found preferable. If a herringbone pinion is desired for the first reduction in connection with a motor, it should never be mounted on the armature shaft, but on an independent shaft connected to the motor through a flexible coupling. The other mounting may cause destructive end whip-

ping of the armature if the load should happen to set up a suitable period of vibration.

The third class consists mainly of turbine drives. High pitch speeds, 3,000 to 5,000 ft. per minute, should not be attempted except with generated gear teeth. The slight inaccuracies due to any other method will render them very noisy and inefficient. Generated herringbone gears have been run at 10,000 ft. per minute. A good oil spray should always be provided at the point where the teeth enter into mesh.

The pitch of herringbone gears may always be made finer than for spur gears for equivalent strength. It is thus possible to obtain smaller pinions, and consequently higher gear ratios. Also, because of the continuous action of such gears, it is possible to use a fewer number of teeth in the pinion. Such pinions have now been made to work successfully with only one tooth.

The preceding classification largely determines the method to be followed in the cutting of the gears. With particular reference to the method of machining the classification will be as shown in the table.

Method of Machining	Type of Gear
A. Planing by templet principle.	1. for slow speed and heavy loads. 2. for smooth and noiseless operation. 4. for high gear ratios.
B. Hobbing—Generating.	2. for smooth and noiseless operation. 3. for high pitch speed. 4. for high gear ratios.
C. End Milling.	2. for smooth and noiseless operation. 4. for high gear ratios.
D. Shaping—Generating.	2. for smooth and noiseless operation. 3. for high pitch speeds. 4. for high gear ratios.

The different methods with their specific characteristics will now be considered in this order.

Usually all gears having pitches greater than 1 D.P. are planed in gear planers working on the templet principle. Planing is an economical method for removing great quantities of metal. The tools are heavy, rigid, and inexpensive, and need therefore not be used with much consideration for their safety. But as the pitch becomes smaller, about 2.5 in. C.P., the method ceases to be economical.

Planing by Templet Principle

There are generally few limitations to planing, fewer than for any other method. The machines are broadly divided into two classes, those carrying one tool and those carrying two tools. Either class requires a clearance pocket at the center of the face 2 in. to 2.5 in. wide. In order to make the casting equally adaptable for both classes, this pocket should be made as shown in Fig. 1. In case the pinion is made of forge steel the pockets may be drilled as indicated at *a*, after which the block is chipped out. For the best work this pocket should then be milled so as to leave no sharp corners. A pinion of small pitch diameter and wide face will have its stiffness greatly augmented by the retention of this bridge. But for cast-steel gears or pinions with less than 4 in. C.P. the bridge becomes so thin that it is a source of weakness rather than of strength.

The stock *F*, left for finishing, should not be less than ½ in. and sometimes as much as ¾ in. to take care of uneven shrinkage of the casting. If the "block" is carried down, as indicated at *D*, there are apt to be "draws" formed at the root and the sand will burn in, thus making it difficult to clean the casting. It is better, therefore, to "block" as indicated at *E*, especially

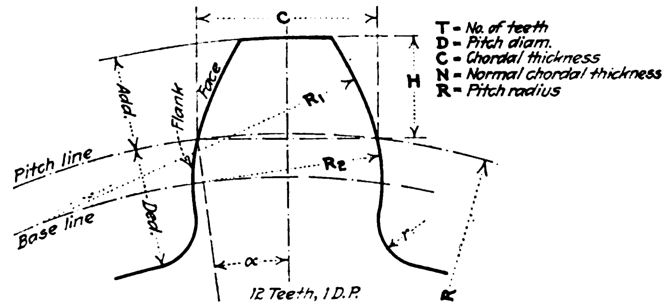


FIG. 3—DIAGRAM FOR CALCULATING CHORDAL THICKNESS

since it will not take any more time for planing. For small pitches the depth *B* of the pocket is a very bad feature in the mold. The hot steel rising in the mold forms eddies at *C*, forming blowholes and dirt which seldom become visible until the gear is rough planed. It is well, therefore, simply to blank all gears with pitches up to 4 in. inclusive, and to cut a groove from the solid to a depth of $\frac{1}{16}$ in. below the root of the tooth.

The helix angle should not be less than such that

$$\tan \alpha = \frac{P}{H}$$

as shown in Fig. 1.

But it should, as a rule, not exceed 23 deg., which is the standard for hobbed gears. Any greater helix angle will cause the normal section of the tooth to become rather thin. Mill pinions, due to their hard service, may be thrown out of alignment. The load may therefore at some instant be thrown entirely on one end of the tooth, breaking out that end because of the weakened normal section.

The face of the gear will be found to be from 6 to 10 times the circular pitch. In our practice a 17-deg. helix angle has been adopted as standard for mill drives. For this case the minimum face becomes

$$F_{min.} = 6.541 \times \text{C.P.} + \text{clearance pocket.}$$

Since a slight amount of overlap is desirable it is convenient to use the formula

$$F_{min.}\text{(17 deg.)} = 7 \times \text{C.P.} + \text{Clearance pocket} \quad (1)$$

The 20-deg. involute stub tooth is the most desirable tooth form. But exception may be taken in the case of heavy mill pinions taking an extreme tooth load. By reference to Fig. 2 it is seen that the involute system places two convex surfaces together, while the cycloidal system brings a convex and a concave surface together. Due to the elasticity of the metal, a certain bearing surface will be obtained, and this bearing surface will be much greater for the cycloidal tooth. But in selecting a cycloidal tooth form regard should be had for the fact that cycloidal gears run correctly only at fixed center distances. Their use where bearing wear cannot be kept within reasonable limits may therefore be inadvisable.

The tooth profile and tooth thickness dimensions are required for the pattern and for cutting the gear and should therefore be given fully on the drawing. The former dimensions may be taken from a good odontograph table or may be determined by an actual

layout. In involute gears there can be no action below the base line and the part of the tooth which extends below is ordinarily made with a radial flank. But this method sometimes leaves a tooth which requires a slight additional rounding at the base line to satisfy appearance. It will be found better to continue the flank radius and to draw the radial line tangent to this arc. The tooth should then be joined to the root circle with a fillet radius equal to about $\frac{1}{10}$ of the circular pitch.

In order to calculate the chordal thickness of the tooth it is convenient to consider the gear as having no backlash. Then

$$\alpha = \frac{90}{T}$$

as shown in Fig. 3 and

$$C = D \sin \alpha. \qquad (2)$$

Similarly,

$$H = \text{Addendum} + R(1 - \cos \alpha). \qquad (3)$$

The dimension H is used for the depth of the gage, but the width of the gage must be made to suit the normal tooth section. Disregarding the slight change in curvature on the normal section, we have

$$N = C \times \cos(\text{helix angle}). \qquad (4)$$

The gage being made to this dimension, the amount of backlash will be determined by the shake of the gage. This amount depends entirely upon the degree of accuracy to which the gears are planed. The friction and inertia in indexing large, heavy gears makes it unsafe to rely entirely on the index wheel, as the resulting errors in tooth spacing may be excessive. Consequently, it is well to finish the upper side of the teeth, after which the variation from the true tooth spacing is gaged. In our practice not more than 0.005 in. variation in the spacing is permitted, and several teeth may have to be replaned to come within this limit. Since it is possible that two such teeth will come in mesh the minimum backlash is 0.010 in., and the total backlash may be given as

$$\text{Backlash} = 0.010 + 0.001 \times \text{C.P.} \qquad (5)$$

Hobbing Herringbone Gears

Nearly all the smaller gears used in mill work may be cut by the hobbing process. Hobbing is a very economical method for gears not exceeding 1 D.P., and such gears should therefore preferably be designed with this method in view. The method employs a hob having an axial section similar to that of a rack, and this hob will automatically generate any gear of a similar pitch. Due to the expensive hob equipment, it has been necessary to standardize the tooth elements. We find, therefore, the following standards fairly well adopted:

Tooth form = 20 deg. involute,
Helix angle = 23 deg.,
Pitch = diametral, with 1 D.P. as maximum,

$$\text{Addendum} = \frac{0.8}{\text{D.P.}}, \qquad (6)$$

$$\text{Dedendum} = \frac{1}{\text{D.P.}}, \qquad (7)$$

$$\text{Minimum face about } 6 \times \text{C.P.} \qquad (8)$$

To avoid interference, and partly to give freer cutting action to the hob, the outside diameter for pinions of 17 teeth or less is given a slight increase.

$$\text{Enlargement} = \frac{2(1 - 0.0585\,N)}{\text{D.P.}},$$

$$\text{where } N = \text{number of teeth in pinion.} \qquad (9)$$

Usually the gear blank is reduced a corresponding amount, thus maintaining the correct center distance. Regardless of this change in the blank diameter, the tooth is cut to the standard depth. The gear requires a clearance space in the center of the blank approximately equal to the circular pitch and of a depth slightly greater than the addendum of the tooth. (These standards were published on pages 329 and 589, Vol. 56 of *American Machinist*.)

Hobs are made with single or with multiple threads. If multiple threaded hobs are used, it may be advisable to have a number of teeth in the gear not divisible by the number of threads in the hob. A distorted hob tooth will then not be able to cut continuously in the same tooth space. The resulting tooth spacing will be more uniform and the gear action correspondingly more smooth and noiseless. As an example, a pinion of 13 or 17 teeth will run very well with gears of 101, 103, or 107 teeth.

End Milling and Shaping

End milling, though much used on the continent, has found little favor in this country. The end mill is a small tool, incapable of standing up against heavy cuts, or of carrying the heat incidental to taking such cuts. The maximum pitch which so far is being milled is about 5 in. circular, and the mean diameter of the mill is therefore only 2½ in. The shape of the mill must be made to suit the normal section of the tooth space. Now, this shape varies for every different pitch, and for every different number of teeth in that pitch. It will require a series of 25 end mills of each pitch to get a fairly close approximation to the correct tooth curve.

One outstanding advantage of the end milling process is that it is able to produce a tooth that is seemingly continuous across the face of the gear. There can, however, be no tooth action at the point of reversal of the helix angle and the radius is, therefore, relieved to avoid interference. Another advantage, which must be shared with planed gears, is the ability to retain a shroud on the faces of the pinions.

Shaping by the molding-generating method or by the shaping-generating method is only used for smaller gears. One machine of the former type, not in use in this country, is able to cut a gear having the teeth meet in a sharp apex. Another machine of the latter type is now being used for gears in machine tool construction. These gears are not being built to a universal standard, and will therefore not be covered in this article.

Standard Tooth Proportions

The involute curve has many advantages over any other tooth curve. It may be generated by a rack with straight sides, and this generated tooth curve may also as readily be ground if required. The 20 deg. pressure angle has now been universally adopted for all classes of work. Since hobbing is the standard process for gears up to 1¼ D.P. or 1 D.P., gears of these pitches will have tooth standards as previously given. Gears with pitches greater than these are principally planed, and it is therefore this class which remains to be considered. Since the heavier pitches are always given in terms of circular pitch, the tooth standards should be given on that basis.

$$\frac{0.8}{\text{D.P.}} = 0.2546 \text{ C.P., and } \frac{1}{\text{D.P.}} = 0.3183 \text{ C.P.}$$

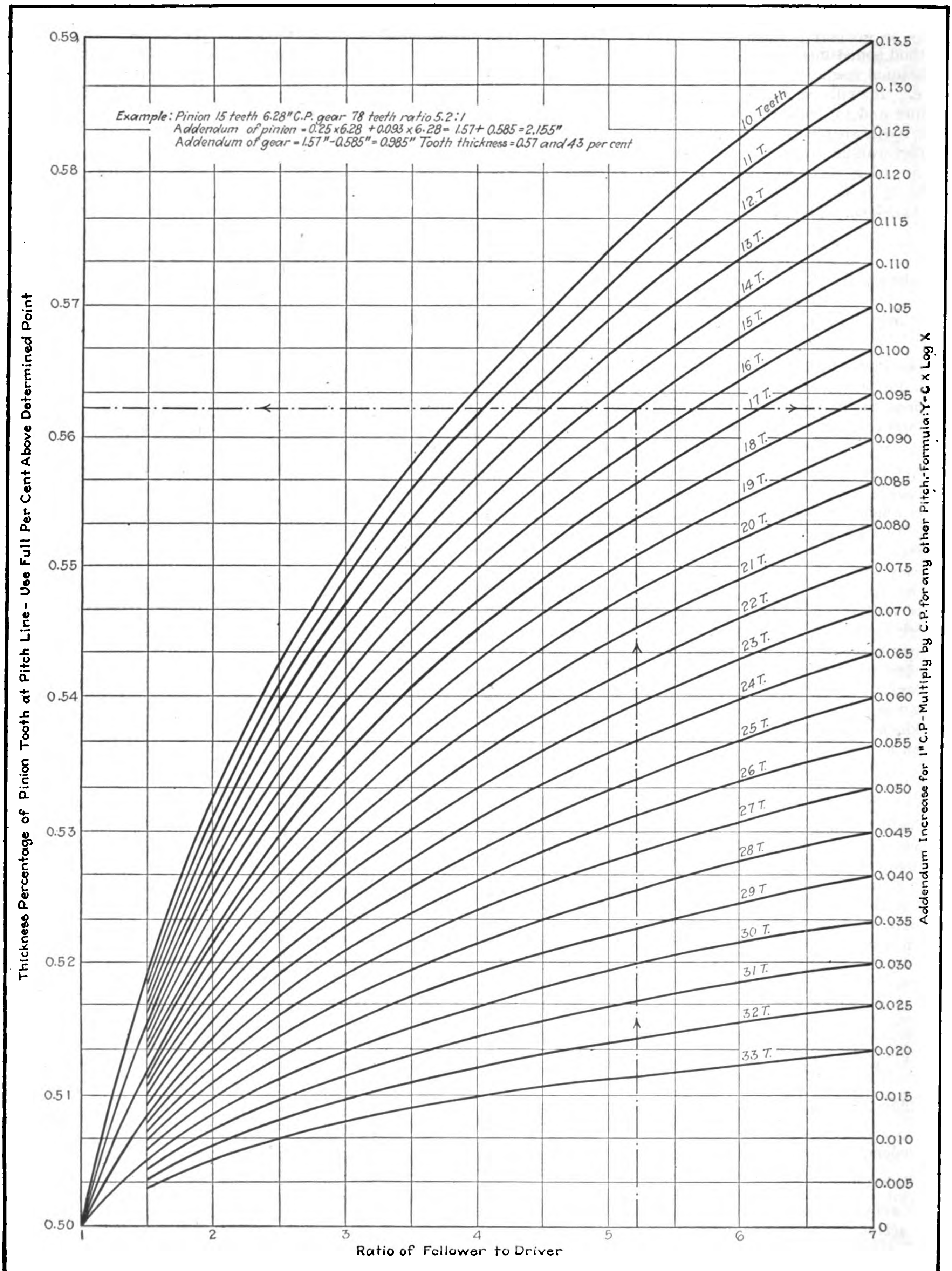


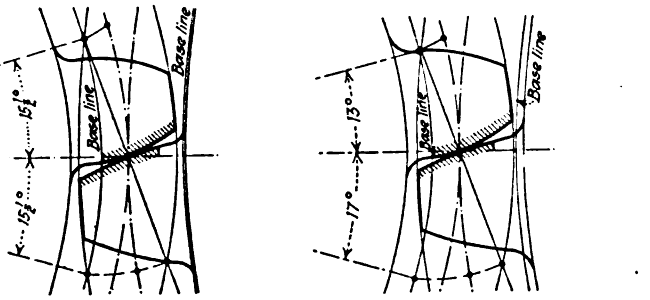
FIG. 4—ADDENDUM INCREMENTS AND TOOTH THICKNESS OF PINIONS

For the sake of simplicity we shall change these to the commonly accepted standards

$$\text{Addendum} = 0.25 \text{ C.P.} \quad (10)$$

$$\text{Dedendum} = 0.30 \text{ C.P.} \quad (11)$$

In heavy gearing there is no need of an interchangeable system. The freedom from restrictions of the "planing by templet process" should therefore be taken into account. It is well known that the tooth action is more destructive on the arc of approach than



Pitch = 1 D.P. - 20° Involute
Pinion 15 teeth Gear 30 teeth
Add. = 0.785 Add. = 0.785
Ded. = 0.943 Ded. = 0.943
Tooth thickness = 0.50
Arc of action = 1.295 C.P.
FIG. 5

Pitch = 1 D.P. - 20° Involute
Pinion 15 teeth Gear 30 teeth
Add. = 0.785 + 0.1065 = 0.8919 Ad. = 0.785 − 0.1065 = 0.6789
Ded. = 0.943 − 0.1065 = 0.8365 Ded. = 0.943 + 0.1065 = 1.0495
Tooth thickness = 0.53 Tooth thickness = 0.47
Arc of action = 1.23 C.P.
FIG. 6

FIGS. 5 AND 6—ACTIONS OF NORMAL AND MODIFIED TEETH CONTRASTED

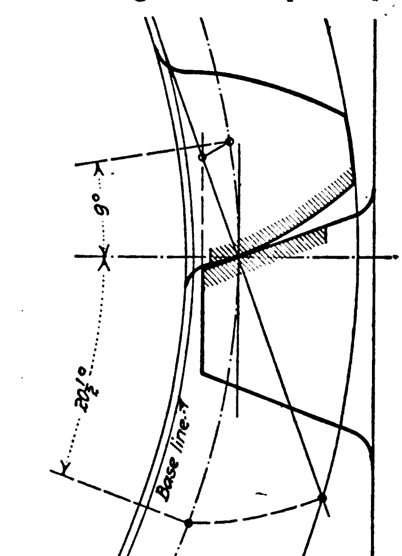
on the arc of recess. The remedy is to increase the addendum of the pinion, as was done for hobbed gears. But the method used for hobbed gears if applied to a set of three high mill pinions of 10 and 17 teeth respectively would give very bad tooth action, as the dedendum of the 17 tooth pinion would be entirely too deep. Any system, to be workable, must take account of the number of teeth in the pinion, the gear ratio, the position of the base circles in relation to the action of the gears, and the arc of action. The arc of action should be greater than the circular pitch, preferably about 1¼ C.P. Appearance demands that the tooth thicknesses be made approximately equal on the apparent pitch diameters, and the resulting pinion tooth will be much stronger than would otherwise be the case. The amount which the pinion addendum should be increased is rather arbitrary, but it has a three-fold purpose:

(1) To eliminate undercut of the teeth;

(2) To insure contact along the entire face of the gear addenda;

(3) To reduce the arc of approach and increase the arc of recess.

As long as the pinion and the gear each have less than 30 teeth the conditions are fulfilled by the first two factors. The gears may therefore be so proportioned that their base circles are equidistant from their respective root circles, and a straight line formula will satisfy the amount of addendum increase. The necessity for the first two conditions disappears, however, as the pinion gets a greater number of teeth. Now, for gear ratios of one to one interchangeability of position is generally required. We find then by trial that the addendum increment is satisfactorily governed by the formula, $y = C \times \log X$, in which y = addendum increment and X = gear ratio. The constant C is determined by trial. Ten teeth may safely be assumed as being the minimum. For hobbed gears the addendum increment would in that case be 0.420 in. for a pitch of 1 D.P., or 0.1337 in. per inch of pitch. For convenience in plotting the curve we will use 0.135 in., making the increment 0.005 in. less for each additional tooth in the pinion. The results are plotted in Fig. 4, which is self-explanatory. A contrasting example is given in Figs. 5 and 6, in which the shaded portions represent the parts acting upon each other. It is seen that the arc of approach has been decreased with a consequent improvement in the relative sliding action. Likewise, the arc of recess has been increased. Due to the small ratio of these gears the improvement is not as noticeable as it would be for a greater gear ratio. A 15-tooth, 1 D.P. piston meshing with a rack is shown in Fig. 7. Here the relative slip has been nearly eliminated on the angle of approach, and the tooth has the stubby profile giving maximum strength.



15 Teeth & rack, 1 D.P.
Add. = 0.7854 + 0.425 = 1.2104 Add. = 0.785 − 0.425 = 0.360
Ded. = 0.9430 − 0.425 = 0.518 Ded. = 0.943 + 0.425 = 1.368
Tooth thickness = 0.57% & 0.43%
Arc of action = 1.2 C.P.

FIG. 7—MODIFIED RACK AND PINION

The strength of herringbone gears is affected by several conditions which are beyond the control of the designer, and which are dependent mainly on the accuracy of the teeth and the alignment of the gears in operation. There are, however, several other conditions which may be determined to a nicety. The formula for strength of gear teeth according to Lewis is

$$W = SPFYK,$$

in which W = load, S = safe stress, P = circular pitch, F = face, Y = tooth form constant, and K = speed factor. Evidently S remains unchanged. Likewise, remembering that the rolling action is in the same plane as for a spur gear, P remains unaffected. The tooth load W, acting tangentially to the pitch line, is accompanied by the side thrust T, giving a resultant force N normal to the helix angle. Now,

$N = \dfrac{W}{\cos \alpha}$, and the gear face measured along the helix $= \dfrac{h}{\cos \alpha}$.

Therefore, the load per inch of face $= \dfrac{W}{\cos \alpha} \div \dfrac{h}{\cos \alpha}, = \dfrac{W}{h}$, which shows that the face F is also unaffected. (See Fig. 8.)

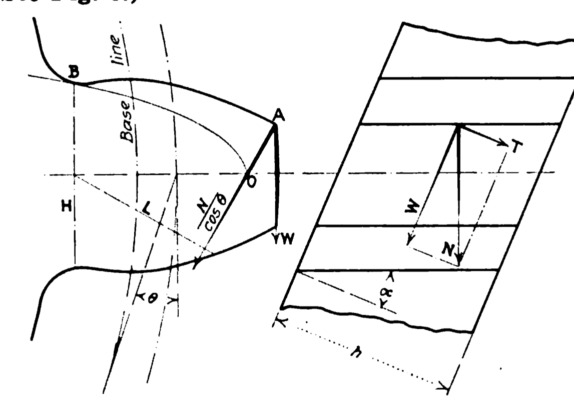
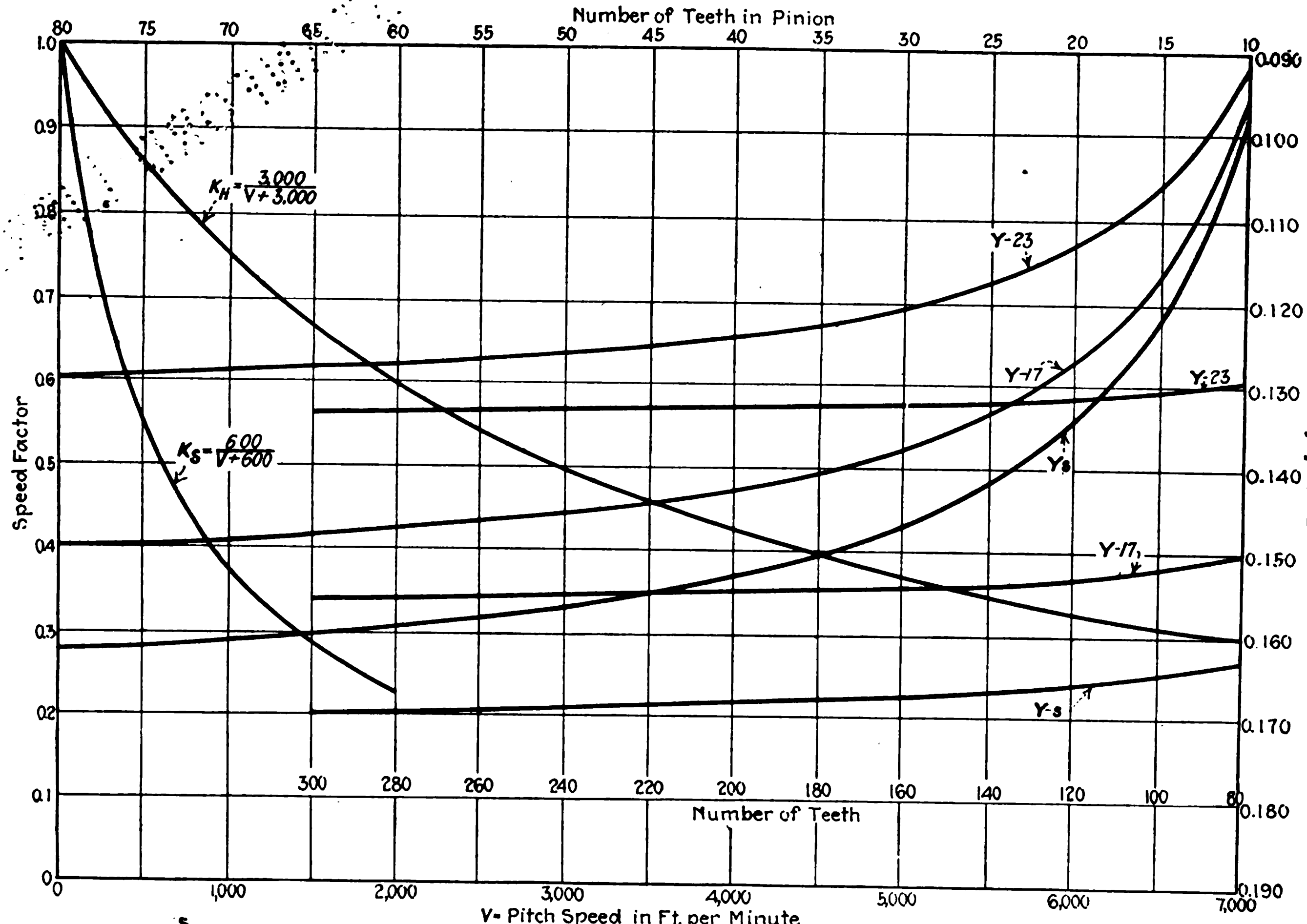


FIG. 8—FORCES ACTING ON HELICAL TOOTH



Safe load $W = \frac{S}{2}$ PFY KO I
S - Safe stress at no speed—see table
P - Circular pitch
F - Total overall face of gear in inches
Y_S - Tooth factor for spur gear
Y17 - Tooth factor for 17 deg. herringbone gears
Y23 - Tooth factor for 23 deg. herringbone gears
K_S - Speed factor for spur gears
K_H - Speed factor for herringbone gears
O - Lubricant factor
1.0 for well oiled gears
0.6 to 0.8 for grease lubrication
I - Addendum increment factor - see S-197
= [2 x tooth thickness percentage]^2 thus $(2\times 56)^2 = 1.254$

Example: Pin. 15 T. - 4" P. - 30" F. - 17 deg. helix - 50 C. F. St. - 1830 ft. per min. - gear 93 T.
W = 12,500 x 4 x 30 x 0.1165 x 0.62 x 1 x 1.142 = 140.000 lb., $\frac{140,000 \times 1830}{33,000}$ = 7,750 hp.

VALUES OF S

METAL	S	ULT. T. ST.
Nickel steel heat treated	30,000	120,000
Forge " 50 C	25,000	100,000
Forge " 30 C	20,000	80,000
Cast " 50 C	20,000	80,000
Cast " 40 C	17,500	70,000
Cast " 30 C	15,000	60,000
Cast iron	10,000	32,000
Cast "	8,000	24,000
Bronze 88-10-2	8,000	30,000
Rawhide	5,000	
Fabric	5,000	

FIG. 9—STRENGTH OF CUT SPUR AND HERRINGBONE GEARS

The speed factor K depends entirely on the accuracy of the teeth. If we assume that spur gears become noisy at 1,200 ft. per minute, ordinary planed or end milled gears at 3,000 ft. per minute, and closely generated gears at 6,000 ft. per minute, we may further assume that the constant K is identical for these cases. We have then,

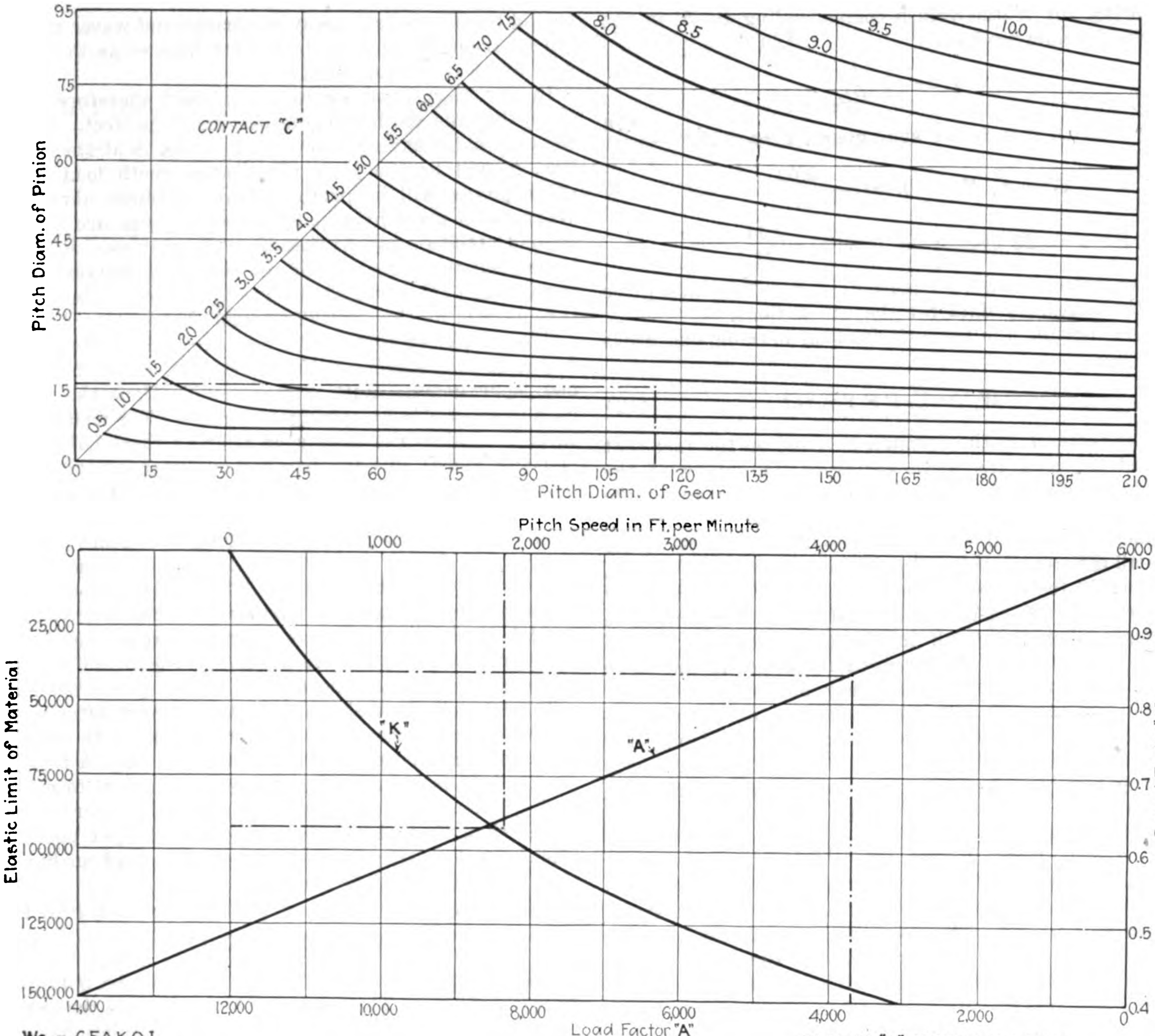
$$K_s = \frac{600}{V + 600} \text{ for spur gears;}$$

$$K_o = \frac{1,500}{V + 1,500} \text{ for ordinary planed or end milled gears;}$$

$$K_g = \frac{3,000}{V + 3,000} \text{ for closely generated herringbone gears.}$$

Now, by painstaking methods, gears may be planed so accurately as regards tooth spacing, true involute, and helix angle that they will show full bearing when run together. For such gears the constant Kg may well be used to the limit of about 3,500 ft. per minute.

The values for the constant Y are not readily solved. In the Lewis method for spur gear teeth it is assumed that a force $\frac{W}{\cos\theta}$, passes through the outer edge of the tooth. Commonly this assumption is incorrect for herringbone gears, in which the load is always concentrated nearer to the pitch line. Observation shows that the wear is usually greatest from the pitch line and out towards the end of the tooth. If we therefore assume that the maximum load occurs at a point half way out the face of the tooth, we shall have shortened the arm L, Fig. 8, about 25 per cent. But the loss of tooth due to the clearance groove is about 17 per cent, leaving 8 per cent still to be considered. The danger from misalignment is a very uncertain element, and is, of course, greater because of the greater ratio of face to pitch. On the other hand, such gears usually receive



Wc - CFAKOI
Wc - Safe load for wear or crushing
C - Contact factor from curve
F - Active face of gear
A - Load factor from curve
K - Speed factor from curve
O - Lubrication factor 1.0 for gears running in oil
0.8-0.62 for grease Lubrication
I - Service factor 1.0 for 10 hrs. per day for 2 years
and from table for other periods
Example: Pin. 15 T.-4" P.-30" F. 50 C.-F.S.-1830 ft./min.
el. limit = 40.000 - service 1 Yr. cont.-gear 93 T.
Wc = 2.8 × 27.5 × 3.700 × 0.625 × 1 × 0.75 = 134.000 lb.

FACTOR "I" UNIFORM LOAD

SERVICE	CONTINUOUS	10 HRS. DAILY	5 HRS. DAILY
3 Months	3.00	8.00	18.00
6 "	1.50	4.00	9.00
9 "	1.00	2.67	6.00
1 Year	0.75	2.00	4.50
2 "	0.38	1.00	2.25
3 "	0.25	0.67	1.50
4 "	0.19	0.50	1.13
5 "	0.15	0.40	0.90
6 "	0.13	0.33	0.75
7 "	0.11	0.29	0.65
8 "	0.10	0.25	0.56
9 "	0.09	0.22	0.50
10 "	0.08	0.20	0.45

FIG. 10—WEAR OF SPUR AND HERRINGBONE GEARS. CLASSIFICATION OF GEAR CUTTING METHODS

better attention. If we therefore charge the remaining 8 per cent to this factor we shall have simplified the calculations in that the face is to be taken as the total overall face. The layouts for Y will therefore be made by the method previously mentioned. But since the forces are acting normal to the tooth it will be necessary to use the normal tooth section for the determinations. Using the formulas developed by A. B. Cox on page 104, Vol. 56 of *American Machinist*, we find that the pitch diameter for the normal section $= D \sec^2 \alpha$. The tooth thickness $= 0.5 \cos \alpha$, and the pressure angle is altered so that

$$\tan \theta = \frac{\tan \theta'}{\sec \alpha}.$$

The force $\frac{N}{\cos \theta}$ is drawn normal to the involute at A, and the parabola constructed from O tangent to the tooth flank indicates B as the point of weakness. The moment tending to break the tooth is therefore $\frac{NL}{\cos \theta}$ with the section along line H resisting breakage. Sub-

stituting for N the values corresponding to W in the Lewis formula we have

$$Y = \frac{H^2 \cos \theta}{6\ PL}.$$

For $\alpha = O$, that is for spur gears, $Y = 0.172 - \frac{0.76}{N}$

for $\alpha = 17$ deg., $Y = 0.158 - \frac{0.62}{N}$

and for $\alpha = 23$ deg., $Y = 0.135 - \frac{0.44}{N}$.

These values have been plotted in Fig. 9, which gives all the necessary data for the calculations.

The formula for the safe load on herringbone gears is then:

$$W = \frac{S}{2} P F Y K O I \qquad (12)$$

The factor I in the formula is based on the fact that the strength of the tooth varies as the square of the thickness along the line of weakness. The addendum increment has, however, a disturbing influence which renders it very difficult to establish a correct factor for all different ratios. But within the limits of Fig. 4, that is 33 teeth, the factor is practically correct. Any error is in all cases on the safe side. It might be thought that the teeth in the gear meshing with a pinion would have its strength impaired at the same rate. But this is not the case as the decrease of addendum more than balances the loss of tooth thickness. It is sufficient therefore to consider I only for pinions having up to 33 teeth. The gain in tooth strength may be as high as 30 per cent, depending on the number of teeth in the pinion and the gear ratio.

Wear of Herringbone Gears

If gears were designed for strength alone they would soon fail from abrasion. Accordingly the safe stress S has been halved. The result will very closely approximate any formula based on wear. The factor O, in formula 12, although not affecting the strength of the teeth, is of great importance when wear is considered. For most cases it is sufficient to calculate the gears from formula 12. But if we want to be more careful, we shall have to approach the subject from an entirely different angle.

Herringbone gears, having correct involute curves, will bear along diagonal lines across the tooth. These lines will travel across the tooth from one end to the other. If the helix angle is such as to advance one tooth there will be one diagonal line passing clear across the tooth. If the advance of the helix angle is in multiples of one tooth there will be a corresponding series of shorter lines. But the total length of bearing line is the same in each case and will not vary much in extent from the straight bearing line of a spur gear.

Should the gear not have true involute teeth the bearing lines would be very much shortened, giving bearing close to the pitch line only. The consequent bearing pressure will then be great enough to crush the material and the result is a deep groove along the pitch line on both gear and pinion. Such conditions may be partly relieved by "running in" under light load. But the amount of "running in" should be moderate. If the gears do not show a fair bearing across the teeth after a few hours run it is due to the helix angles not meshing properly. Any great amount of "running in" tends to destroy the proper tooth profile and is therefore harmful. The object of "running in" should be only to take away toolmarks and waves transmitted from the gearing in the machine so as to eliminate all local bearing surfaces.

In our discussion for wear we shall therefore consider that the tooth is made practically perfect. Since the only point having true rolling action is at the pitch line, it will be the place of greatest tooth load. All other points will be partly relieved through abrasion. Wear takes place principally when surfaces are loaded beyond a certain amount, and, as the unit load depends largely on the curvature of the two tooth curves bearing on each other, we shall have to consider this curvature as well as the elasticity of the metals.

The subject of contact has been well treated by C. H. Logue in the "American Machinist Gear Book" for 14½-deg. spur gears. With a few modifications the same data is applicable to herringbone gears. The writer has therefore taken the liberty of altering these curves to suit the 20-deg. involute herringbone gear, as shown in Fig. 10. The contact C has been calculated for 20 deg. involute curves, the radius of the curvature being taken as 0.5 D sin 20 deg. Since herringbone gears nearly always run in oil the value of A has been increased 50 per cent so as to make the lubrication factor unity in such cases. Also, the curve for A has been based on the elasticity rather than the hardness of the metal. The curves for the relative hardness of gear and pinion have been left out. The normal run of gears used in mill work do not receive any heat treatment after they are cut. The gears may be made from 30 to 40 carbon cast steel and the pinions from 50 to 60 carbon forged steel. This is about as hard as it is practical to make such pinions, and they will consequently wear much faster than the gears. But being the cheaper part to replace, and as spare pinions are usually kept on hand, this is entirely satisfactory.

The formula will then be written as shown in Fig. 10,

$$Wc = C\ F A K O I \qquad (13)$$

The notations and explanations may all be obtained from the figure. The example there given is the same as was used in Fig. 9 for the strength calculations. It will be noticed that the agreement is fairly close. We shall have to accept the values of the service factor I until better experimental data is obtained.

Conclusion

The technical press has recently shown an intense interest in gears of all kinds. But much is yet to be learned, especially of herringbone gears. Where, in earlier days, such gears were made to ample dimensions, greater competition and efficiency will now demand a much smaller gear for the same capacity, and this can only be done with great attention to details. The user of machine cut herringbone gears should therefore assure himself of obtaining gears having a minimum error in tooth spacing, a minimum backlash, a tooth profile as true to the theoretical curve as it can practically be made, a tooth bearing clear across the face of the gear without excessive grinding together, a tooth bearing which is not only localized at the pitch line, but extends well out along the tooth profile. And, having such gears, he should see that they receive proper attention, that the lubricant is of sufficient body to carry the load without being sticky or gummy, that the shafts are kept in proper alignment and the bearings well adjusted. Good gears may be ruined in a short time by lack of attention to these details.

Hot Galvanizing

Methods Employed—Design and Construction of the Plant with Suggested Layout—Selection and Care of Equipment

BY CLAUDE O. KELL

EXPOSURE of iron and steel to the atmosphere without protection invariably causes corrosion. By coating these metals, protection can be given in two general ways, non-metallic and metallic. The non-metallic method consists in covering the material with some organic matter, such as paint, varnish or oil. In the metallic method of plating, the iron or steel is covered with some other metal, usually zinc or tin.

Galvanizing is the trade name of coating metals, most commonly steel and iron, with zinc. Three methods of accomplishing this are, (1) electroplating; (2) sherardizing or dry galvanizing; and (3) hot galvanizing. The last of these methods is the one here treated in detail.

The method of hot galvanizing can best be divided into the following operations: cleaning, fluxing, and dipping or galvanizing.

Before either iron or steel can receive an adherent coat of zinc, the article must be absolutely clean and free from all sand, rust, paint, or other foreign matter. This cleaning process may be accomplished either by tumbling, sand blasting, burning, or pickling, that is, by treatment with acids.

CLEANING BY TUMBLING

Malleable castings and small forgings can be freed from sand and scale by the wet or the dry tumbling process. In wet rolling, a tumbling barrel is packed with the material to be cleaned, sand, water, and a small amount of either muriatic or sulphuric acid. In the dry rolling process, the barrel is packed alternately with the articles to be cleaned and small cast shapes known as "shot." Great precaution must be taken in packing the barrel that too much space is not left empty, thus allowing excessive play within the barrel. This may result in fracture to fragile castings. Tumbling has the great advantage of producing a smooth, polished surface on articles and at the same time removing sand from sand pits or castings, or scale from forgings. This polished surface cannot be obtained by pickling in acids. Although the tumbling barrel is a very highly desirable part of the equipment of a galvanizing plant, it is not altogether necessary because cleaning can be done satisfactorily by pickling in acid and by sand blasting.

Sand blasting is a very efficient but comparatively slow method of cleaning sand from castings or slight scale and rust from forgings and plate work. A very cheaply constructed, but efficient sand blast, consists of a piece of ½-in. steel pipe about 12 in. long with a T-connection at one end. One lead is taken to a source of air of about 75 to 100 lb. pressure, while the other is connected to a container of fine sand. Sand blasting produces a polished and smooth clean surface, but has the disadvantage of being expensive, due to labor cost.

Paint is easily removed by burning it off either with a torch or in a furnace. In either case care must be taken not to subject the material to temperatures that will change its chemical and physical properties.

Pickling, which is the treatment of material with acid, is the most common method of cleaning material in small plants. Sand is readily removed by a warm, weak solution of hydrofluoric acid, about one part acid and twenty parts water by volume. There is a danger involved in the use of hydrofluoric acid, however, in the formation of the silicate of the acid. This is a very poisonous gas, but it can be guarded against by suitable equipment and ample ventilation of the plant.

CLEANING BY PICKLING

Material is most commonly pickled in sulphuric acid. A solution of one part acid and twenty parts water by weight is strong enough. The solution will be more effective if heated to a temperature of about 150 deg. F. and kept agitated. This can be done easily by a blast of air from the bottom of the tank along its length. A lead pipe, 1 in. in diameter, with holes ⅛ in. in diameter drilled on 1-in. centers is suitable for such a blast in a tank of about 500 gal. capacity. Muriatic acid may be used for pickling but it is not preferred since it is not as cheap as sulphuric acid. If the pickling solution is not heated and is not agitated, a stronger solution will be necessary to accomplish results. In the interest of economy and to prevent pitting of the metal by a stronger solution, the weaker is recommended.

To prevent over-pickling of the less corroded parts, it may be necessary to remove the heavier rust and scale with a scraper. The length of time necessary for for pickling is, of course, dependent upon the condition of the material and is best governed by experience. Overpickling must be guarded against. Seams and pits in the material are indications of this. Upon removal from the sulphuric acid bath, the material should not be exposed to the air, but should be washed in fresh water preparatory to entering the muriatic bath for fluxing.

FLUXING AND GALVANIZING

Fluxing is the treatment of material in a weak solution of muriatic acid after it has been cleaned. The chloride salt which remains on the iron after it has dried, upon removal from the muriatic acid bath, acts as a very efficient flux. The consistency of one part commercial muriatic acid and fifteen parts water by weight is recommended for fluxing. To heat this mixture produces a very nauseating gas, and the advantage gained by heating is not considered great enough to warrant this disadvantage. If work is thoroughly cleaned, treatment for four hours in the muriatic acid bath is considered ample. After the material is dry it should not remain in the atmosphere long before dipping as this will allow a slight coating of rust to form.

Before material can be dipped into the zinc bath, it must be thoroughly dried, after being removed from the muriatic bath. Drying can best be done on a hot plate, heated either by gas or by a coke fire. It is not necessary to keep this plate at a high temperature,

about 200 deg. F. being sufficient. In small plants where a drying plate or oven is not available, the plates over the fire boxes around the kettle serve very well.

The temperature of zinc is a great factor in the success and effectiveness of the coating obtained. The melting point of pure spelter is 419 deg. C., or 786 deg. F. (Smithsonian Physical Tables, 1916). For galvanizing small work handled in baskets, such as small stampings and castings, the temperature should be higher, say, about 90 deg. F.; while for plate work the zinc should be about 950 deg. F. The temperature of the zinc should be recorded constantly and this can be done best by a pyrometer fitted with base metal thermocouples.

Before an article is dipped, the surface of the zinc should be cleaned with a scraper and covered with gray salammoniac, which acts as a flux. Gray salammoniac is preferred to white salammoniac, since it is cheaper and does not vaporize as readily. A few drops of glycerine will make the salammoniac adhere as a mass on the surface of the zinc. In dipping, pass the article through the salammoniac slowly, until it is entirely submerged. This operation must be done slowly, to prevent sputtering of the zinc which might injure the workmen. Allow the article to remain in the zinc entirely submerged until it has reached the temperature of the zinc, which is indicated by the ceasing of the bubbling action. Withdraw the article slowly through the salammoniac and examine it to see that every part of the surface is coated. If not, apply salammoniac freely to those parts not covered and lower again into the zinc. Examine again before preparing to withdraw the article finally. Before hoisting the article from the zinc for the last time, brush the salammoniac clear, leaving a clean surface on the zinc. Allow all surplus metal to drip into the kettle.

Large castings can be cooled by dipping in warm water covered with oil. Small castings should not be dipped into water to cool, but allowed to cool in the air as dipping these in water may cause cracking. Plate work should be sprinkled with water and allowed to cool in air. This produces the spangled appearance of such pieces.

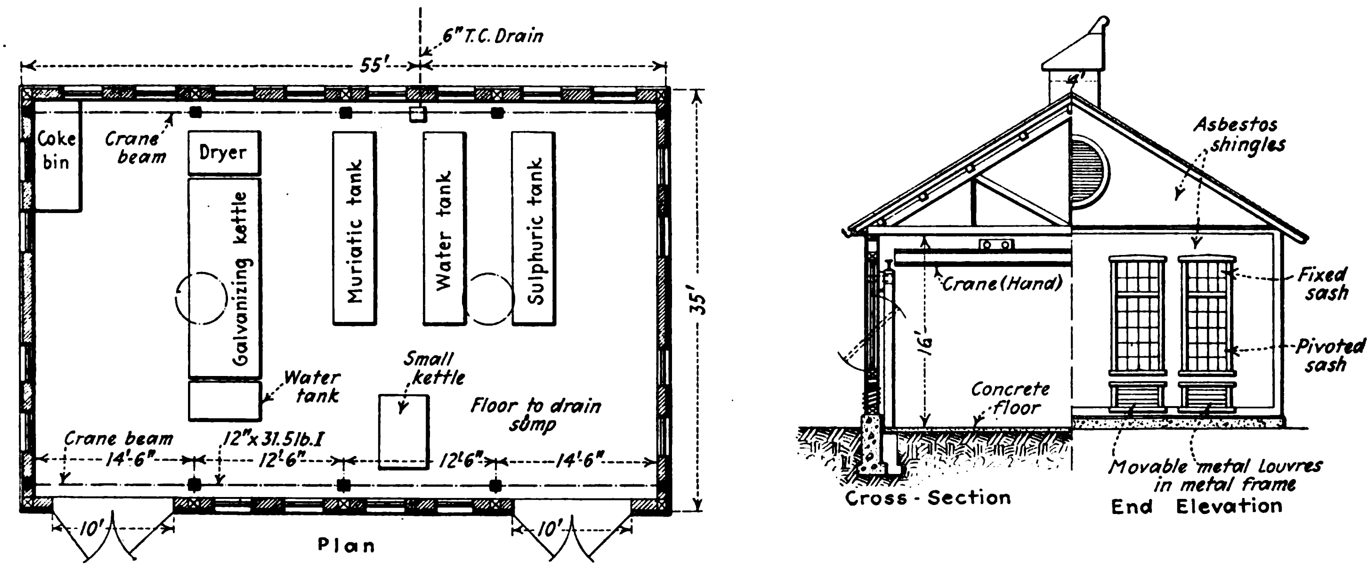


FIG. 1—PLAN AND ELEVATION OF GALVANIZING PLANT

The quality of work in galvanizing is governed to a large extent by the purity of the zinc. The kettle must always be kept free from dross, which is a compound formed by iron and its impurities passing into solution with the zinc. Sources of dross are mill scale on material galvanized and the iron from the kettle itself. For this reason it is most important that the kettle be constructed with suitable material.

Plant Construction and Equipment

It is most important that the building in which a galvanizing plant is housed, be designed to give a maximum amount of ventilation, in order to insure the expulsion of all fumes arising from pickling tanks and the kettle.

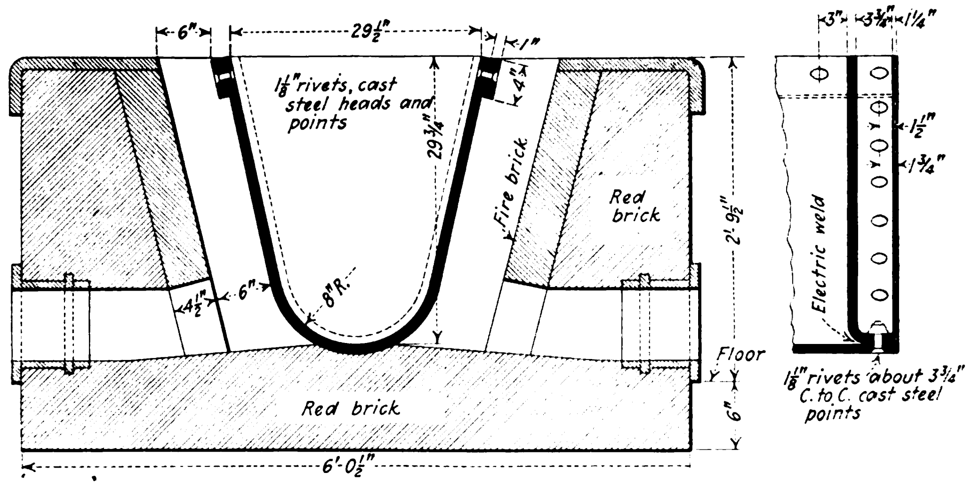


FIG. 2—SECTIONAL VIEW OF U-SHAPED KETTLE AND METHOD OF INSTALLATION

In Fig. 1 is shown the plan and elevation in section of a building designed to house a plant of about 3 tons per day capacity. The long windows are spaced closely together and are pivoted, enabling them to be opened

wide. Below the windows are louvres which act to create a draft upward through the ventilators when weather conditions make it necessary to keep the large windows closed. Natural ventilation is preferable because a forced draft blower is liable to act to keep the fumes low within the plant. Hoods may be designed to cover the pickling tanks and kettle but these have the disadvantage of interfering with work. A concrete floor is desirable because it is not materially affected by acids and can be cleaned readily. The plan view gives the logical layout of tanks and kettle designed to minimize transportation within the plant and facilitate handling of materials. For transportation an overhead traveling air hoist is most satisfactory where compressed air is available foı power. This type has two advantages, viz., its atmospheric exhaust works no hardship upon operators; and its ruggedness minimizes repair and upkeep costs.

To determine the most satisfactory grade of iron with which to manufacture galvanizing kettles, extensive experiments have been made. These have shown, conclusively, that the resistant qualities of iron to the molten zinc are nearly in proportion to the degree of purity of the iron. Carbon and nickel, as impurities, particularly, should be avoided. Specifications for a satisfactory iron should allow no greater percentages of impurities than the following:

Carbon	0.12 of 1 per cent or less
Manganese	0.2 of 1 per cent or less
Phosphorus	0.01 of 1 per cent or less
Nickel	None.

The U-shaped kettle as illustrated in Fig. 2 in section is the most satisfactory design. This design has advantages over the rectangular shaped kettle in that it permits a more even heat distribution through the volume of zinc and is more easily drossed and kept clean. In the rectangular kettle dross collects and remains in corners and along the edges. This causes overheating in these parts and thereby accelerates the destruction of the kettle by burning. Plate at least 1 in. thick should be used, and if possible the kettle should be rolled from a single plate. Riveted joints except at the ends should be avoided. To facilitate drossing the kettle and to prevent the dross adhering to the bottom of the kettle, it is good practice to keep about 8 to 10 in. of lead in the bottom of the kettle.

The life of a kettle depends to a great extent upon the care in firing. Precaution should be taken not to allow the zinc to solidify and to prevent excessive temperatures with the danger of burning the kettle. This can be done with little attention by using oil or gas fuel. If coke is used, uniformly clean fires about 6 in. thick and in depth equal to the height of the zinc in the kettle, should be kept. Large coke is best since this gives a greater percentage of voids which allows better circulation of air throughout the fire.

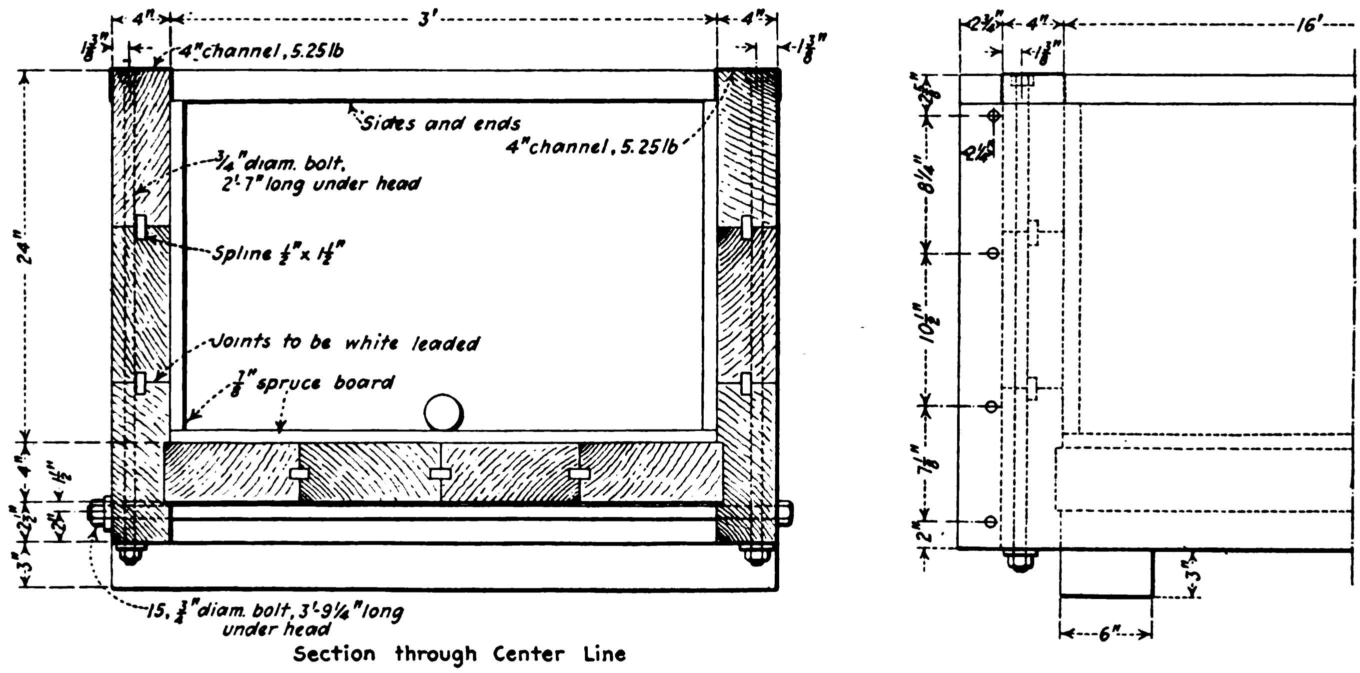


FIG. 3—DESIGN DETAILS OF PICKLING TANKS

In firing a new kettle, it is of greatest importance that the operation be slow and that no part of the kettle be subjected to concentrated heat. Before lighting the fires, the kettle should be packed carefully with enough ordinary pig lead which, when melted, will have a depth of at least 8 in. On top of this, slab spelter should be packed making sure that all of the surface of the kettle is in contact with the zinc. When possible, it is well to pour melted zinc down the sides of the kettle to insure its surface being covered. No less than forty-eight hours should be required to melt down a kettle of zinc and bring it up to temperature ready for use. It is believed to be economical to use only first-class virgin spelter marketed by a reliable firm rather than use the remelt spelter which may be obtained at a much lower price. In the latter case it has been found that a great percentage of the spelter is lost as dross.

Details of design of suitable pickling tanks are shown in Fig. 3. Either long leaf pine or spruce are preferred as material with which to build them, in view of economy and the resistant qualities of the woods to acids. The edges of the tanks should be protected by inverted channel bars as shown. To protect the bottom and sides of the tank against cutting and pricking by plate edges, a thin lining of spruce should be used. This can be easily and cheaply renewed and prolongs the life of a tank greatly.

P. A.—Discussion

By C. J. Morrison

The remarks of Charles W. Lee on page 337 regarding purchasing agents are very much to the point and treat an important subject—one so important in fact that more should be said until a large number of purchasing agents are reformed.

In too many cases the thought seems to be that any dub can do the purchasing, and totally incompetent and inexperienced men are made purchasing agents. Before being made purchasing agent, a man should have at least some experience in both manufacturing and selling, and the broader the experience, the better will he fill the position.

This thing of keeping salesmen waiting for long periods, of haggling over prices, of knocking the firms they represent, and of generally treating them as something different from human beings is not only all wrong, but is costing an awful lot of money. Purchasing agents and salesmen should be good friends and work together for their mutual interest. That this is possible is illustrated by a number of cases, but particularly by the purchasing agent of a very large concern which, in fact, is the largest of its kind in the world.

This man has a large corps of assistants, but they handle the details and he personally sees every salesman who calls. Moreover, he tries to keep no one waiting for more than a few minutes and if there is to be an unavoidable delay, he goes out to the salesman, tells him the probable length of time before he can be seen, and either gives him a definite appointment or allows him to wait, just as the salesman may elect.

Rules for the Purchasing Agent

A very successful general manager wrote instructions for a man he had just promoted to purchasing agent, and the ones which apply to business in general are given below:

See every salesman who calls.

Treat a salesman as courteously as you would a customer.

Do not keep a salesman waiting. If a delay is unavoidable, go out to him and offer a definite appointment.

Tell no salesman from whom you are purchasing.

Tell no salesman the prices you are paying.

Be truthful to the salesmen.

Do no haggling over prices and do not tell a salesman at what price you will buy. It is the salesman's duty to name his price. We do not buy from a house that names a price and then lowers it to make a sale. Our competitors might buy from the same house at a still lower price.

Do no knocking. If you are not satisfied with the service or merchandise of any concern, tell the salesman of that concern, in a courteous manner, the trouble. Talk to no salesman about any company except his own and yours and be sure to advertise your company.

Study the markets, the political situation, the financial conditions, and the agricultural prospects—all of these for both this country and abroad. Your department is supplied with the best trade and technical journals, with a daily financial and a daily market report paper, and with one of the leading newspapers and you are supposed to study them.

On a falling market, buy only enough at a time to keep the plant running and allow the stock on hand to fall to a minimum, but on a rising market buy in large quantities and increase the stock to the maximum. Never be in a hurry to buy. Few buy actually at the bottom and it is far safer to buy a few points above the bottom, when prices have turned definitely upward, than to buy at what you think is the bottom only to find that prices are still falling.

Study the scrap and spoilage reports from the plant, and if they are rising above normal, find out whether or not the fault lies with something you are purchasing.

Make frequent trips through the plant so as to familiarize yourself with the uses made of the things you purchase. Perhaps you can suggest some change to reduce costs, but no change should be made until after the factory manager has been consulted and the consent of the general manager secured.

Be sure that prices, discounts, terms, quantities, delivery dates, f.o.b. point, etc., are clearly stated.

Specifications are provided for nearly all of the regular items that you purchase and with each purchase order should be included the specifications for the items on that order. When specifications are not provided, be sure that the goods ordered are so specifically described that no misunderstanding can arise.

A Case of Expensive Ignorance

These paragraphs from the instructions apply to almost any business and this would make a good place to stop, but I feel inclined to tell a personal experience which illustrates the ignorance of some purchasing agents and also shows that the management does not always do its part. Some time ago our salesmen who were calling on a company to whom we were anxious to sell reported that the purchasing agent could not be seen as he seemed to have duties more important than interviewing salesmen and that the assistant to whom they were referred was "impossible," so I decided to make a call.

Although my card was sent to the purchasing agent it was the office of the assistant to which I was admitted. After delivering a long talk on prices and trying to impress me with the idea that he always bought at a lower price than anyone else, the assistant consented to allow me to tell him what I had to sell. He then told me what I already knew, that they made the article themselves. I explained to him that the manufacture of this article was entirely foreign to their regular work, and this fact, combined with the fact that they made the article only in small quantities, would make the cost higher than our selling price, as the article was a specialty with us and was made in very large quantities on special patented machines of our own design which were far more efficient than any machine they could purchase. Moreover, the fabrication of this article gave a very large waste of raw material for which they had no use, while we used it for other purposes. As this sounded reasonable, he consented to receive a quotation and I asked for specifications, to which he replied, "We have no specifications, but I will give you samples."

He sent for samples, and after receiving them I said, "Now if you will tell me the limits, you will receive a rock bottom quotation in the morning's mail."

He replied, "We have no limits. Your goods must be exactly like the sample, without any variation whatever." When I tried to explain, he said, "Limits would have nothing to do with the costs. If you cannot make the article, say so, while if you can, submit a price; but remember that your articles must be exact duplicates of the sample or they will not be accepted."

As argument availed nothing, I left and the next day submitted a very low price for the article "to be made similar to sample within the usual commercial limits for this article which are —," giving the limits we used for other customers. We did not get the order and, as far as I know, that company is still making the article at a much higher price than it could be purchased because no one will make it for them "exactly like sample." I wonder how many others are in the same boat.

Methods of Machine Tool Design

Fourth Installment of Section on Feed Mechanisms—Rack Feeds and Their Limitations Cam Feeds—Intermittent and Uniform Motion Cams

By A. L. DE LEEUW
Consulting Editor, *American Machinist*

FEW REMARKS need to be made about the main elements of a rack feed mechanism. As a rule, a rack feed is not used where accurate distances must be obtained. A high degree of accuracy would not be obtainable with racks and pinions as ordinarily made in the machine shop. Nevertheless, there are cases where it is desirable to lay off distances by means of rack and pinion. In such cases one should make the pinion with circular and not with diametral pitch so as to be able to say that one revolution of the pinion corresponds to four, five, six inches, or whatever it may be. As a rule, a rack feed is not used for the heaviest kind of work so that the very heavy pitches need not be used. If the work is moderately heavy, the rack should be fastened to the frame of the machine by screws and heavy dowels, or preferably by screws and cross keys.

Large Reduction Advisable

One should keep in mind, when designing a rack feed, that the rod or shaft which comes from the driving end and goes to the rack feed mechanism should run at relatively high speed; that is, it should make a great many revolutions for one revolution of the pinion. There are two reasons why this is necessary. In the first place, the feed shaft is, as a rule, of considerable length and must be kept limited in diameter to meet the conditions of the feed mechanism—let us say in the apron of a lathe. Therefore it is impossible to avoid excessive twist and perhaps breakage of the rod unless it runs at much higher speed than the feed pinion. In the second place, such a rod transmits the power by means of a spline, and the coefficient of friction between rod and key is necessarily great, partly because neither the spline nor the key has the best kind of finish nor could this be maintained if they had it, and partly because the conditions of lubrication are necessarily of the poorest for a splined rod.

How a Direct Drive Would Act

Suppose the splined rod should be keyed directly to the rack pinion. Let us suppose this rack pinion to be of 3 in. pitch diameter and the splined rod to be 1 in. in diameter. Then for one revolution of the splined shaft the key must travel in an axial direction as much as is the circumference of a section of the rod. The result is the same as if the load were pushed in a horizontal direction and had to climb an incline of 45 deg. Besides, there is to be considered the large friction angle which may cause the same result as if this load had to climb at an angle of 45 plus the friction angle. This angle may be so considerable that the device becomes self-locking. If, on the other hand, the splined shaft were so geared to the rack pinion that twenty revolutions of the shaft were required for one revolution of the pinion, then the key would have traveled only $\frac{1}{20}$ of the previous distance per revolution of the shaft. Thus the load would have been pushed up a gentle incline. Another reason why this large reduction is necessary is that otherwise the pressure of the spline against the key would be several times the load on the rack pinion and would cause excessive wear. If the lathe carriage had been working for some time over a certain region of the lathe bed, the spline would have been worn to a shoulder, causing trouble when later on we want the carriage to work in some different region.

It is always possible to give the feed rod the necessary speed but it is more difficult to arrange this matter properly when a feed screw is used also as feed rod. Let us assume that we have a medium sized lathe upon which threads can be cut from one to twenty-four to the inch and in which the smallest rack feed is 0.01 in. or, practically, one-fourth of the finest lead. If the gearing at the head-stock end is so arranged that we will get $\frac{1}{24}$ pitch, this same gearing will also make a 0.01 in. feed. If the gearing is set for the largest possible lead, namely 1 in., we shall obtain with the same arrangement a $\frac{1}{4}$ in. feed. If this screw had a lead of 1 in. which, as we found, was desirable for screw feed, we would have the condition that one revolution of the screw would cause $\frac{1}{4}$ in. feed when it is used as a feed rod. This small reduction, though it would not lead to self-lock, is undesirable, causing excessive wear and producing a hard and irregular action of the feed.

Cam Driven Feed Mechanisms

Books might be written about cam feeds and many excellent articles and treatises have been written on the action of cams. We shall have to confine ourselves here to those properties of cams and those requirements of cam feeds which are directly applicable to the design of machine tools. Cams are almost exclusively used in automatic machines because they are necessarily limited in their range and, at a first glance, do not seem to lend themselves to variations in the requirements of the machine. As a matter of fact, such variations are not possible if we consider the cam alone. A cam, however, considered in combination with its driving mechanism, may lend itself to many variations in the duty it has to perform.

The simplest kind of cam and cam arrangement has a constant lead, advances the machine element the same amount at all times, and has provision for returning that element as quickly as possible. Change gears or any other speed variator in the driving mechanism of that cam may permit of changing the amount of time required for a complete cycle. The requirements for such a cam are that its slope should be as gentle as possible and that in order to obtain the greatest economy of time the return should be as steep as practical.

There are two distinct ways of utilizing cams in a mechanism. The cam may either be used for one definite function or it may be arranged to take care of one complete cycle of the machine. To illustrate: The cam used for the shifting of the belt on a Brown

For the author's forthcoming book.

and Sharpe screw machine belongs to the first class. It has one function only, it shifts the belt and does nothing else, and moves only at the moment when the belt must be shifted. A cam of the second kind is the one used on the Spencer Hartford screw machine, on which there are all the elements required for the various advances and retreats of all the turret tools as well as for the indexing. Idle spaces on this cam permit another cam on the same shaft to attend to the chucking, stock feed, etc., between the feeds of the turret and cross slide tools. If the arrangement of the machine would permit, it might be possible to have these two cams consolidated into one. The full revolution of these two cams completes an entire cycle of the machine.

Functioning of a Typical Cam

There are other cams on such machines, but they are all mounted on the same shaft. The effect is the same as if they were all built into one member. Though we say that one cam takes care of the advances of the various turret tools, the truth is, each turret tool has its own cam but all cams are mounted on a single drum. This mounting of a number of cams on a single drum serves the purpose of assuring a proper sequence of operations and a proper proportioning of the rapidity of feed and the amount of advance of each tool. There is no possibility of the machine getting out of time. Operations cannot be mixed up if once properly set. To analyze better the functioning of such a cam we will take a concrete example, selecting some imaginary screw machine with four turret tools, one cross slide tool, and so arranged that the indexing of the turret is accomplished by a cam and not by the mere backward movement of the turret. Starting with the first tool, we will have the following sequence of operations:

a — quick traverse forward of first tool,
also quick traverse forward of cross slide tool,
b — feed of first tool and cross slide tool,
c — quick return of first turret tool and cross slide tool,
d — dwell of first tool and cross slide tool, and
d-1 — unlocking of the turret,
d-2 — indexing of the turret,
d-3 — locking of the turret,
e — rapid advance of second tool,
f — feed of second tool,
g — quick return of second tool,
h — dwell and, at the same time,
h-1 — unlocking of the turret,
h-2 — indexing of the turret,
h-3 — locking of the turret,
i — rapid advance of third turret tool,
j — feed of third turret tool,
k — quick return of third turret tool,
l — dwell of third turret tool and, at the same time,
l-1 — unlocking turret,
l-2 — indexing turret,
l-3 — locking turret,
m — rapid advance of fourth turret tool,
n — feed of fourth turret tool,
o — quick return of fourth turret tool and, while these operations have gone on, there may have been,
p — shifting of the belt for the purpose of tapping, and
q — shifting back of the tapping belt,
r — dwell of fourth turret tool and, at the same time,
r-1 — unlocking turret,
r-2 — indexing turret,
r-3 — locking turret,
s — dwell for first turret tool and, at the same time,
t-1 — opening chuck,
t-2 — feeding chuck,
t-3 — closing chuck,
t-4 — returning feed shell.

This completes the entire cycle. To a certain extent some of these elements may overlap each other.

Such a cam may be run either at a uniform speed or it may have a slow and fast motion. We will assume that in the imaginary machine we have under consideration the cam will sometimes move slow and sometimes fast, the slow motions being used only for feeding. Then we find that all the movements except for *b*, *f*, *j*, and *n* are fast movements of the turret. Thus, only a relatively small fraction of the circumference of the

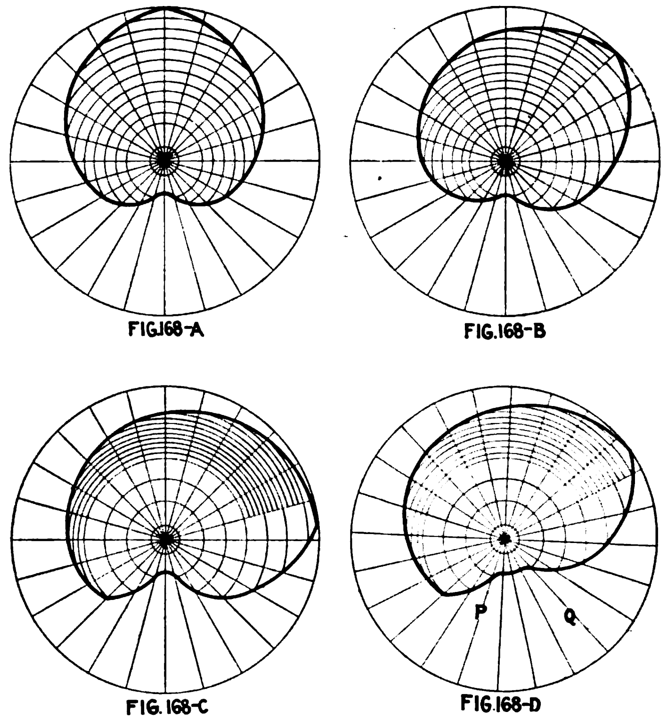


FIG. 168. SEVERAL FORMS OF FEED CAMS.

drum is used for the purpose of feeding whereas all the rest is used for what might be called "non-productive movements." As a result, such a cam must be made of large diameter, though the amount of feed and the number of tools to be fed may be small.

There is another difficulty in connection with the camming of such a machine. To set up a new job requires a complete analysis of all the detail operations and a careful calculation of the parts of the cam drum available for each function. We will go further into this matter later on and first consider the various other arrangements in existence or possible arrangements which might be made.

Perhaps the simplest arrangement of all is the cam which turns at uniform speed, has a uniform advance, a uniform return which may be at the same or different speed as the advance, and no idle space to permit some other function to take place. Such cams might be used for a variety of machines, as for example filing machines. A modification of this arrangement would permit a machine to stop at the end of every cycle by the throwing out of a clutch or a drop-worm. Cams of this description are quite commonly used in special

machines. They become more generally useful if the advance is not uniform.

Fig. 168-A shows a cam with the uniform and equal advance and return. Fig 168-B shows the cam modified with a uniform advance and rapid return and Fig. 168-C shows the same type of cam for rapid advance, slow feed, and rapid return. Fig. 168-D, finally, shows a cam which has the same characteristics as Fig. 168-C, except that it has idle spaces left for other operations. This idle space is a concentric part, *PQ*.

The cams are shown in the illustration as disk cams, though there is no reason why they should not be constructed as drum cams. As the diagram shows them, no provision is made for the return and this would have to be accomplished by a weight or spring whereas it might be accomplished by having a groove act on the roller instead of depending on the outside of the cam disk. The shape of the return branch of the cam, 168-C, is not objectionable when a spring or weight brings the slide back but if such a cam were provided with a groove, so that the cam becomes active instead of passive, there might be danger that the device would become self-locking, and it might be necessary to make the return less rapid. As a compromise, the cam might be made with a groove and, in addition, a weight or spring might be provided to bring the slide back so that the return side of the cam only works if, for some reason or other, the spring or weight should not be sufficient.

Keeping Operations in Synchronism

When a cam is constructed on the principles of Fig. 168-D—that is, with idle space for some other operations—it becomes necessary to connect the two functions in such a manner that they cannot get out of time with one another. The simplest way of accomplishing this is to have the other functions also controlled by a cam and then place the two cams on the same shaft and in the proper relation to each other. If, for instance, a slide at the righthand end of the machine had to be advanced and returned, after which a similar slide at the lefthand end of the machine had to go through the same movements, it would be natural to use two cams on the same shaft, each one occupying about one-half of the circumference. If the two slides to be moved were close together, the two cams would be consolidated into one, each function requiring about one-half of the circumference. We see, then, that whether we use one or two cams their size is not changed and must be as large as if only one cam were used for both operations. When there are a great many different operations to

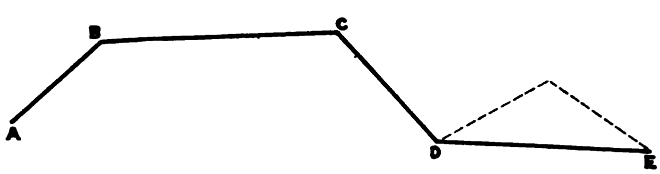


FIG. 169. DIAGRAM TO SHOW DURATION AND SPEED OF VARIOUS MACHINE FUNCTIONS.

be performed on the machine, the cams naturally take on very large proportions.

It might be thought that the size of such cams could be reduced by performing part of the operations at a high speed but as a matter of fact this has a tendency to increase, rather than to decrease, the final size of the cam. To illustrate how this may happen we will take a concrete example. In Fig. 169, the full line from *A* to *B* shows the rapid advance of the slide, from *B* to *C* feed, from *C* to *D* return, and from *D* to *E* dwell, during which another operation takes place. The cam intended for that other operation is indicated by dotted lines. This second operation is not a feed for a tool and the steepest permissible slope for the cam might be used here. This steepest slope we will assume to be 45 deg. and this angle is actually used on the advance and return of the main cam (shown in full lines).

It will be noticed that the dotted line is not shown at this angle of 45 deg. The reason is that in our device the member to be moved by the dotted line cam is very heavy and does not permit of the same rapidity of movement as that member which was shown by the full line cam. If the two cams had been separate and without any connection with one another, the dotted line might have been drawn at an angle of 45 deg. and we would have given this cam a speed which was proper for the heavy member to be advanced. In that case the dotted line cam would have occupied less space than it does now. Under such conditions, then, we have the choice either of making the dotted line cam at an angle of 45 deg., reducing the fast speed of the entire mechanism and thus lose time, or of making the dotted line cam of gentler slope and thereby increasing the size of the entire cam.

Electrolytic Deposition of Iron for Building Up Worn or Undersized Parts

By David R. Kellogg

The electrodeposition of iron has been practiced for many years. During the war, the British army repair shops developed a method for building up worn parts of automotive machinery, aero engines, etc., using the cold sulfate bath and low-current density method. The method has been used successfully in commercial work for the production of about 6,000 repaired parts, therefore experiments along the same lines have since been made at the Westinghouse research laboratory.

Current used for cleaning was obtained from a ¾-kw. 60-volt, house-lighting generator, direct connected to a 2-hp., 870-r.p.m., 440-volt, three-phase, type CS induction motor; while the plating current was taken from the storage batteries at any desired voltage. The anodes were made from 0.036-in. Armco iron made into cylinders 5 in. long by 8 in. in diameter with a disk of ⅛-in. micarta, having a 2-in. hole in the center field at each end of the cylinder for stirring. The anodes were hung on a wooden rocker frame driven by a wooden connecting rod directly connected to a small reducing gear, such as is sold by most of the apparatus supply firms; three-gallon stoneware crocks were used as containers.

Uncertain Behavior

A solution used by Thomas, 75 g. of the crystallized ferrous ammonium sulfate per liter, was tried, using the current density recommended by him; namely, 0.33 amp. per sq.dm. Under these conditions the deposit on a ½-in. (12.7 mm.) rod of cold-rolled steel was smooth, bright, and adherent; it withstood bending and refused to chip off even when attacked at the junction of coating and parent metal with a cold chisel. A current efficiency of

Extract from a paper presented at the February meeting of the American Institute of Mining and Metallurgical Engineers, in New York.

about 75 per cent was obtained, the rate of deposit being about 0.000197 in. per hour.

Baths thus prepared were rather uncertain in their behavior, being especially likely to oxidize when used with small pieces. Adding ferrous-carbonate "mud," kept under water after preparation, somewhat reduced this tendency to oxidize and hence increase in acidity. Powdered charcoal helped to secure a good deposit, and was used in all subsequent work.

After the work had been cleaned with gasoline or benzine, it was made the cathode in an alkaline bath containing about 5 per cent commercial lye and about the same amount of sodium carbonate, the exact amount being immaterial. A current density of 3 to 5 amp. per square inch was used. The work was treated in this bath for 3 min. Then it was washed in running city water and made the anode with approximately the same current density in 20 to 30 per cent commercial sulfuric acid for an equal length of time. As a matter of fact, the current in the acid cleaning bath was always adjusted more with respect to the free gassing of the anode than with respect to the actual current density.

When for any reason the cleaning current was too low to make the work passive, cleaning was unsuccessful, the piece came from the bath dark colored, and a good coating could not be produced. If the work were moved about during the anode cleaning it rapidly became active but again became passive on cessation of the motion. When this condition was very noticeable, it was a good indication that the cleaning current was close to the lower limit. With a current density of 5 amp. per square inch this effect was not so noticeable. After cleaning in this manner, the work was well washed and immediately transferred to the plating bath. With the plating solutions at room temperature, it was possible to deposit at the rate of 1 amp. per sq.dm., which is three times the rate given by Thomas.

Durability of the Deposit

This process gave smooth, tough, adherent coats which, when deposited on a carefully ground rod 0.485 in. in diameter and then ground to a thickness of 0.001 in. could be pressed through a hole in 1-in. cold-rolled steel 0.0005 in. smaller than the finished size of the rod, and then pressed back again with no signs of stripping. These test rods could be bent and mishandled in various ways with no damage to the coat.

A motor shaft having bearings ⅝ in. in diameter by 1½ in. long was purposely finished 0.002 in. small in diameter, plated oversize, reground to proper dimensions, and then assembled and run in bronze bearings for 1,000 hr. with a load of 50 lb. per square inch projected area, using a short stiff belt with a clipper joint in order to give a pounding effect as well as friction. At the end of the run it was found that the wear was 0.0002 in., which is just a trifle less than the original material shows in factory life tests.

Plug and thread gages have been repaired by this means and have given good satisfaction although they are not as hard as heat-treated tool steel. It is, of course, possible to carburize such pieces, when they will compare favorably with the original gages.

Resistance to Cutting

Another interesting job done by this method was on the throw bearing of a crankshaft of an experimental gasoline engine where the maximum pressure was about 650 lb. per square inch. This was given about 100 hr. intermittent running and then 400 hr. continuous running. During the first period, two "freeze ups" occurred, as a result of experiments with various bearing metals; yet when the engine was taken down for inspection the bearing surfaces were in perfect condition and showed a wear of 0.00025 in. Many press fits and running fits have been repaired for shop use and no case of failure has occurred. Coatings obtained by this method are much harder than pure iron; they are usually about 220 Brinell.

Some work of N. B. Pilling, of the Westinghouse laboratory, as yet unpublished, has shown that the brittleness due to occluded hydrogen may be completely removed by heating for ½ hr. at 300 to 400 deg. C.

When cast iron is put through the electrolytic cleaning process, it emerges from the acid with a coating of graphite. A piece was dipped in arsenic-chloride solution and then copper plated in an acid copper-sulfate bath. Iron coatings deposited on this base were fairly adherent.

Acidity of Bath

In connection with all this work a rather close watch of the acidity has been maintained. It now appears, that this is unnecessary as the hot concentrated bath produces such complete anode corrosion that oxidation is practically negligible. The addition of small amounts of ferrous-carbonate mud is still practiced, but the amount used is very small. These baths may be left for weeks when not in use, without any serious oxidation. They have also been worked for weeks at a time, most of the work being done during the daytime, as the rapid rate of deposit, 0.004 to 0.005 in. per hour, makes it possible to do almost any job in one working day.

In addition to a large number of test pieces, between seventy to eighty salvage jobs have been done for the shop, running all the way from the badly scored end of a 1/20-hp. motor to an experimental airplane propeller hub. For the electrolytic cleaning of the larger pieces, we used a 300-amp. arc welding M-G set, with the series field coils short-circuited and with a potentiometer rheostat across 110-volt direct current for the shunt field. This arrangement, together with the regular field rheostat, gives a fine adjustment of current, so that the set may be used for small work, or for work requiring up to 450 amp. for cleaning.

Great credit is due to Leon McCullouch, J. P. Thomas, and J. D. Alleg who carefully handled the experimental part of this work and contributed many valuable ideas to its development.

The Welding Torch and Cast Iron

We are informed by a correspondent that the statement contained in the article on the "Application of the Welding Torch to Railroad Repairs," published on page 444 of our Sept. 21 issue, to the effect that the oxy-acetylene torch would not cut cast iron, is no longer correct. He states that the Oxweld-Acetylene Co. of Chicago has perfected a torch that will do this work.

In making the statement that the torch would not cut cast iron the writer of the article had no intention of conveying the impression that the oxy-acetylene flame would have no effect upon this metal. The reason that the torch has hitherto been considered impractical for this purpose is that the cast iron yields too readily, leaving a ragged, uneven edge instead of the clean knife-like cut produced upon steel.

Taking the Air in England

Present State of the British Airplane Industry—Post-War Stagnation in Bristol Plant 400 Hp. Radial Engine and Ten-Passenger Plane

BY HENRY OBERMEYER AND ARTHUR L. GREENE

A GREAT deal has been written about the impoverished condition of the American aircraft industry, the failure of Congress to lend a helping hand, and the indifference of army and navy officials to the future development of the Air Service. One hears the same sort of thing in England. Parliament is appropriating little or nothing and the British aircraft factories are living on the crumbs that fall from the London to Paris commercial and passenger lines and from certain distant principalities which are engaged in wars at present or expect to be so occupied in time.

Admiral Sir Percy Scott, a leading exponent of a more extensive British Air Force, in a recent article contributed to the London *Times*, notes that the British Government is preparing to spend only £11,000,000 on its air defences. This sum he terms "ridiculous."

"The size of our Naval Air Service to-day is simply absurd," he adds. "During the war it was found necessary to equip every light cruiser with a fighting aeroplane. Today we have six fighting aeroplanes for the whole Navy, less than one per fleet."

The general situation described by Admiral Scott is fully confirmed by a visit to Great Britain's greatest airplane factory by the writers. The machines of this concern, the Bristol Aeroplane Company, Ltd., are recognized as the official standard in use by the British Government. The 400 hp. Bristol "Jupiter," a nine cylinder air-cooled radial engine, virtually every part of which is manufactured and assembled in the company's shops, is said to be the only airplane engine that has ever passed both the French and British official tests. It weighs only 698 lb. or 1,745 lb. per hp., an unusually low proportion.

Industry in Peace

The factory today is a graphic example of the transition from war to peace in the airplane industry of the country. It is their ready adaptation to the new conditions that has enabled the British builders to advance to their present position and not any paternal assistance. The necessities of the war enabled British manufacturers to indulge in practical experimentation on a scale impossible for American firms whose planes were never put to actual use at the front. Many of the improvements developed in English factories during the war period have been lasting and have proved as important to the development of commercial flying as to that of scouting. This circumstance has brought England well to the fore and it is the general impression among manufacturers there that America is only marking time.

The wartime spurt, then, is the chief reason why British manufacturers have advanced in the face of discouragements as real as those in America. In some cases they have even advanced further than the market. In anticipation of extensive passenger-carrying operations on the Continent, the Bristol factory some time ago turned out an air limousine capable of carrying sixteen persons in addition to the pilot and mechanic. The cabin of the machine represented the *n*th degree of twentieth century luxuriousness. There was but one thing the matter with it. There were no passengers. Only on rare occasions was it possible to collect sixteen passengers at the same time who wanted to make the trip.

For the time being, therefore, Bristol is compelled to concentrate on the ten-passenger machine, shown in Fig. 3, which is amply spacious to meet the demands of the immediate future. This temporary check has left the inventive faculty free to experiment with new types of engines, which has now reached its culmination in the huge air cooled static radial, the "Jupiter."

American Development Slow

The manufacturers of the Bristol machines are so confident that they have left our own manufacturers behind that they are beginning to ask: "What is the matter with the United States?" They assert that there has been little, if any, new development in aircraft manufacture in America since the collaborative Liberty motor. It might be here mentioned that the British experience with the Liberty motor has left an impression that America is more given to quantitative than to qualitative production. They admit that the principle of the American engine was excellent, but, in a majority of cases, it had to be taken apart and reassembled before it would work up to standard.

British headway in the development of aircraft engines is far in advance of progress in the construction of planes, partly, of course, owing to lack of support from the Government and the general public. The fact is, the type of planes now in flight is considered quite satisfactory for the uses to which they are being put. Except for minor details, it is practically the same as that used by the British air forces during the last few months of the war. From the Bristol "Fighter," which is being used by Spain against the Moors, as well as by other governments, Bristol has developed a three seated touring plane for the Western Australia Mail Service. This machine is scarcely different in principle from the machines of 1917.

Engines Further Developed Than Planes

Active development of aircraft engines by Bristol is comparatively recent, dating back scarcely more than two years. Before that time, Bristol planes were equipped variously with the 110 hp. Le Rhone, the 275 hp. Rolls-Royce, the 240 hp. Siddeley Puma, and the 300 hp. Mercury. In beginning the construction of its own engines, Bristol took over the entire business of the Cosmos Engineering Company, Ltd., located on the Filton training field near the outskirts of Bristol proper, together with all patents, designs and rights in connection with the various engines previously manufactured by that organization.

Bristol devoted its attention from the start to the radial type of engine as likely to develop the greatest power with a minimum of weight, always the great de-

sideratum in aircraft design. The additional advantages of the air-cooled engine influenced the trend of subsequent experiments.

The reasons which decided the Bristol company to devote its attention to the radial engine are possibly obvious. Experimentation proved that the grouping of many cylinders around a single throw crankshaft would permit the use of the smallest possible shaft and crankcase, and, as these are two of the heaviest single parts in an aero engine, the saving thus effected in motors of radial design is considerable. Another important feature is the short stiff crankshaft in which periodic vibration is cut to a minimum.

Reasons for Use of Radial Engine

The advantages of a radial air-cooled engine over power units of other types were so apparent that the Bristol company early in its experiments devoted nearly all its time to the development of this type of engine. It represented a feature of commercial airplane engine design even more important than that of the military plane. It meant that the possibility of decreased weight implied a proportionate increase in the revenue producing cargo which could be carried.

Another factor taken into consideration was the increased reliability arising from the absence of possible leakage in the water connections, pipes, jackets or radiators; the impossibility of freezing either at high altitudes or in cold weather, and the freedom from trouble arising from the overheating of the water during flight.

The nine cylinders of the Bristol engine as now assembled are in a single plane and have a bore of 5¾ in. with a stroke of 7½ in. The engine is made in two types, the first ungeared and the second fitted with an epicyclic geared reduction of 0.656 to 1. The reduction gearing is interposed betwen the crankshaft and the propeller, and with the engine running at 1,600 revolutions per minute and developing 400 B.H.P., the propeller turns at 1,050 revolutions per minute.

Unique Mixture Distribution

The cylinder heads are of aluminum with two inlet and two exhaust valves, and take care of the distribution of the major portion of the heat. The single induction pipe branches at the entry into the cylinder head while the exhaust is conducted away through two separate heads, thus obtaining a smooth flow of mixture to the cylinders and allowing a free passage of air across the cylinder head. See Figs. 1 and 2. The crankcase is an aluminum casting of two parts, the joint being in a vertical plane.

One of the most interesting features of the "Jupiter" engine is the induction chamber, shown in Fig. 6, an aluminum spiral casting constituting a three-start spiral. The annular cover of the induction chamber carries three Claudel carburetors, each of which feeds a separate convolution. One carburetor supplies mixture to the second, eighth and fifth cylinders, the second carburetor supplies the third, ninth and sixth cylinders, while the third supplies the fourth, first and seventh. This arrangement, it is claimed, allows the mixture a clean sweep from the carburetor to the induction pipe. It further isolates the cylinders into three perfectly balanced groups so that, should one or even two carburetors fail to act properly, a sufficient number of cylinders will remain in action to carry the plane.

The entire engine is supported on a removable framework of thin wire struts, as shown in Fig. 4, almost spidery in appearance but actually capable of bearing a tension many times over that required. The engine may thus easily be removed and changed in case of trouble, with little loss of time which is an obvious advantage in the carrying of mail.

In many cases the manufacture and assembling of the Bristol "Jupiter" in the shop is a reversion to the days of hand labor. Quantity production is frowned upon. With a force of 160 men, the Bristol Company will consider itself well satisfied to turn out as many as sixty engines during the next year. That, at least, is the production quota it has set for itself, although at this writing the shop is more than one machine behind schedule. Views of the shop are given in Figs. 5 and 7.

Hand Labor in Vogue

Hand labor here, moreover, is hand labor in every sense of the word. Some parts, such as the induction spiral, are so complicated that no machine has been made that can fashion them. Not even a filing machine is used on the spiral, the work of filing it down by hand requiring many hours of painstaking endeavor.

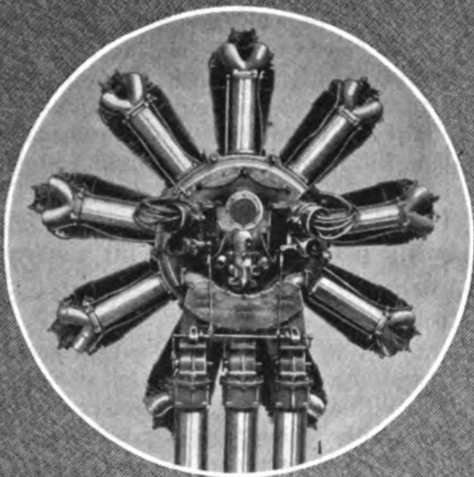
As a matter of fact, the British have had almost no experience with quantitative production in engines. Something in that direction was attempted during the war, but the project lapsed with the fulfillment of wartime contracts. In the automobile field the Rover stands virtually alone as a product of quantity output, but even the Rover total, 300 cars a week, is little compared with the sausage machine production of Henry Ford. From the standpoint of the airplane, day work and handwork are more than sufficient to meet the needs of the moment when even the slowest factories are turning out more planes than they can dispose of. If the prophets are right, however, the time is not far distant when the practical importance of the airplane in commercial life will be more universally recognized. Then a way will have to be found to speed up production; and it is a way that American manufacturers have known for years.

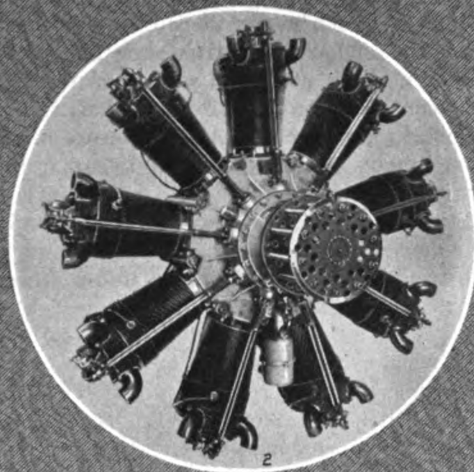
French Manufacturers Get Government Aid

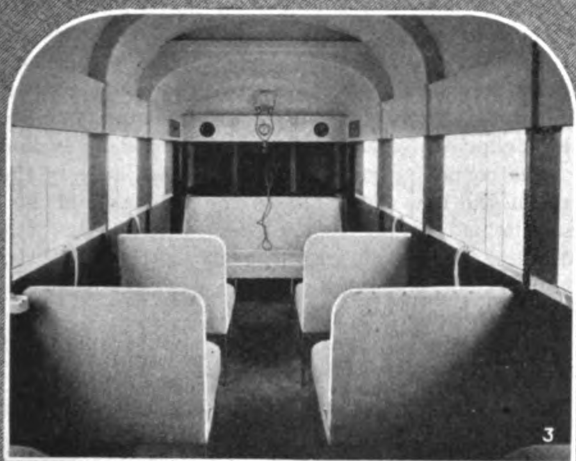
Despite a very real achievement, therefore, British airplane manufacturers may be considered as having gone as far as they can for the present. The air ministry has not given them the support they had hoped for after the war, certainly nothing commensurate with the financial nourishment provided by the French Government for its native industries. This advantage of the French is a bitter pill for British airmen to swallow because of the fact that France is paying practically no interest on her debt to Great Britain, while the money expended in developing her own aircraft industry is approximately equal to the interest she would otherwise have to pay.

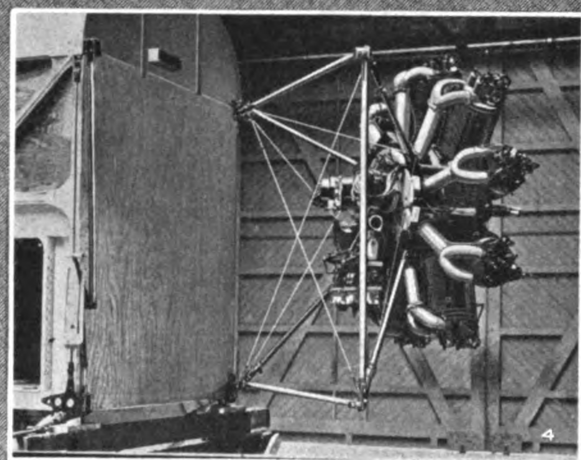
The English position in airplane production was given by Mr. Douglas Vickers, M.P., chairman of Vickers, Ltd., at the fifty-fifth annual general meeting of the company in Sheffield during the latter part of July.

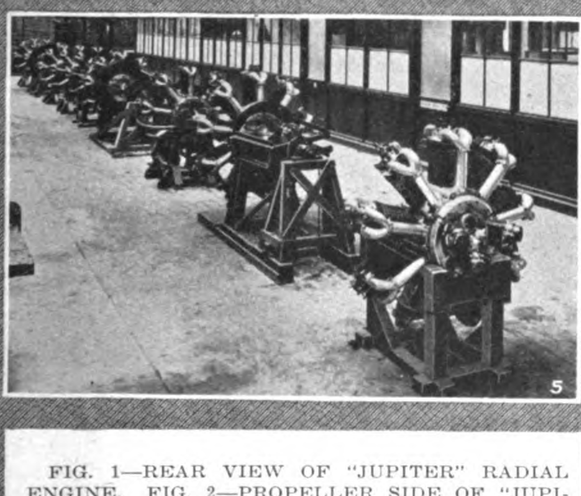
"We are getting our share of such airplane orders as are being placed," he said, "and our type of machines are very successful. But orders come for such small quantities that the cost of designing and experiments bears much too high a proportion to the works' costs of a machine. The position of an airplane manufacturer here contrasts very unfavorably with that of the French manufacturer who gets orders for large series

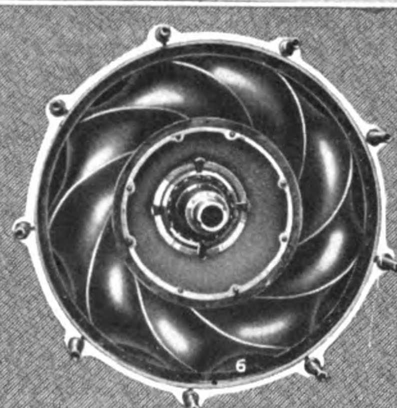












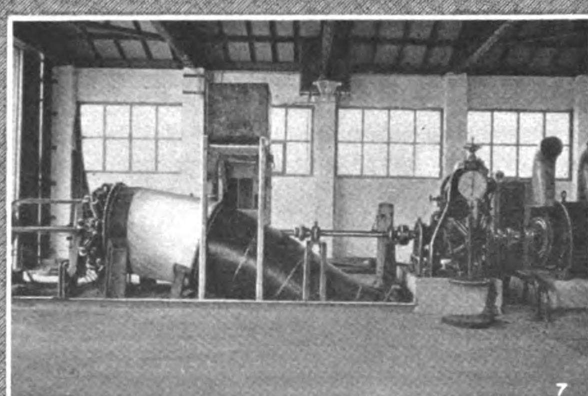


FIG. 1—REAR VIEW OF "JUPITER" RADIAL ENGINE. FIG. 2—PROPELLER SIDE OF "JUPITER" 400-HP. ENGINE. FIG. 3—INTERIOR OF TEN-PASSENGER LIMOUSINE. FIG. 4—ACCESSIBLE FUSELAGE MOUNTING OF RADIAL ENGINE. FIG. 5—RADIAL ENGINES ON ASSEMBLING STANDS. FIG. 6—THREE-START SPIRAL INDUCTION CHAMBER. FIG. 7—TEST BLOCK WITH DEVICE FOR COOLING ENGINE.

of machines and works with much reduced charges and all advantages of repetition work."

The British frankly hope that the next step will be taken by America, which is considered far behind in the manufacture of passenger and cargo-carrying machines. For this reason no little attention was attracted in England by the recent decision of A.H.G. Fokker, the Dutch airplane expert, to abandon Europe and devote his talent to the development of American aviation. If Mr. Fokker's project of establishing a network of aerial lines along the Atlantic seaboard is realized and a sufficient number of Americans are educated to use them, much will be done to overcome the handicap under which the airplane industry of America is laboring.

Incidentally, many British experts, seeming to resent the fact that Americans have ideas of their own in airplane construction, have suggested that American manufacturers can do little better than to import a number of the most recent European models, adopt them "in principle" and continue their experiments from that footing.

The Value of Calculation in Machine Shop

By W. H. Kellogg

The following case may serve to show how a little calculation in the making of a tool or any simple device, is a profitable investment in time.

A jig was wanted, low in cost and high in weight. At the same time, the requirements of its use made it somewhat difficult to devise, and it took about two days to work out the design that would cover these points. When the layout was made it was found that the casting for the frame looked rather heavy, so the designer roughly figured its weight by writing all of the dimensions of each rectangular element, and with a slide rule determined the volumes, writing them down opposite each set of dimensions in one column to be added, the whole operating taking about ten minutes.

Then looking at the design again from another angle, a different form of casting was conceived which could be made without changing the principle of the mechanism. In thirty minutes more a rough drawing was made, which was true in outline and fairly close to scale, and from it another calculation was made, the result of which was 43 lb., as against 92 lb. in the first design.

As no detailing work had been done, no loss of time for additional work was necessary in making the change except the forty minutes that was already consumed for the two calculations and the rough drawing. The saving in the cost of the casting more than paid for the time of considering this change, and the result of the work was much more satisfactory as the reduced weight made the tool so much easier to handle.

While such simple facts may seem commonplace, the writer thinks that in calling attention to this circumstance, many other cases will be brought to mind in which no drawing or even a sketch was used. In many such cases it may be remembered that some parts of the mechanism were made that could not be used, as certain points in the design could not well be foreseen, also that considerable time was spent in making these parts as well as trying various ways of doing the work without a definite outline to go by. Probably a few hours at the drawing board and a few additional sheets of paper would have cost considerably less than the time and material used in this way.

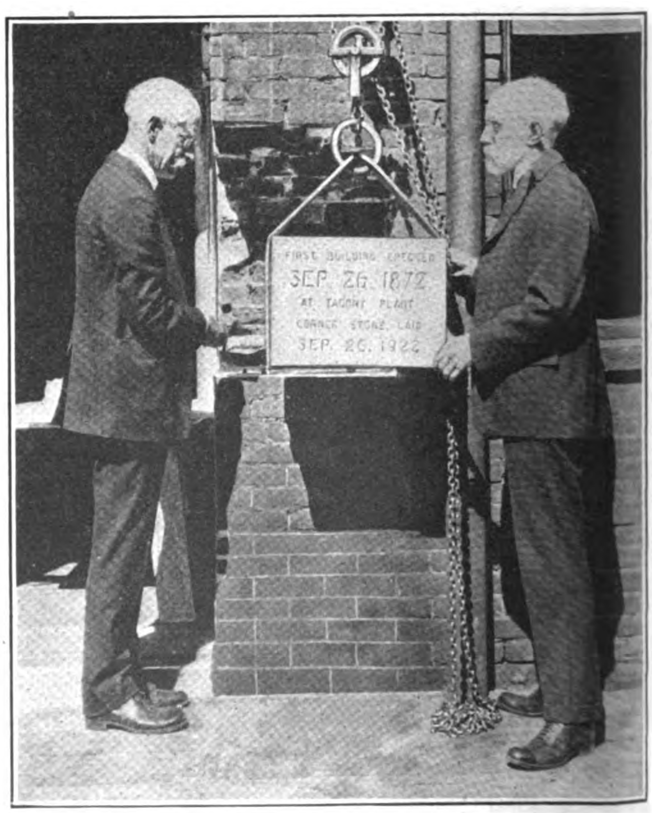
There are few machine shops large enough to employ twenty-five men or more, that could not profitably use a good designer for the purpose of looking into many little problems such as these, even though very little original work is needed. The placing of machines to save floor space, the arranging of the room in the shop or office to save unnecessary movements, the improvement of belt drives to save belting and eliminate friction, the saving of material by changing the design of manufactured parts, and numberless other things of varied kinds can be improved in a profitable way by the simple application of careful thought and calculation.

Laying a Corner Stone 50 Years After

When Henry Disston, founder of Henry Disston & Sons, Inc., needed a new plant in Tacony, Phila., 50 years ago there was no time for ceremonies and ground was broken by Henry Disston, Samuel Bevan, chief engineer, and William Smith, who succeeded Mr. Bevan. Fifty years later, September 27, 1922, the corner stone was laid as shown herewith, by Jacob Disston, Sr. (the only surviving son of the founder), and William Smith, who assisted in breaking ground 50 years before.

Of equal interest, and even more unusual, was the witnessing of the ceremonies by 54 Disston employees who were working for the firm when the Tacony plant was started. The Disston saws date back to 1840 when Henry Disston began, alone and by hand, to make them in a cellar on Bread Street, near Second, in Philadelphia.

The corner stone was dedicated not only to the starting of the new plant but to the veterans whose service had helped to make a success possible, as stated by William D. Disston, grandson of the founder. It speaks volumes for the kindly relations existing in this plant that the number of veterans is increasing year by year. There is something worth while about a plant when men stick to the job year after year.



LAYING THE CORNERSTONE

Building Axles for the Franklin

Some of the Special Tools and Methods Used in Making a Tubular Front Axle and a Combination Steel and Aluminum Rear Axle

BY FRED H. COLVIN
Editor, *American Machinist*

ALTHOUGH nearly all builders of automobiles have adopted forged axles of the I-beam type, the Franklin designers still believe that the tubular front axle presents the best answer to the many demands made upon it by the various stresses and road shocks. It is retained even though its cost is probably higher. Methods used in making such an axle are of special interest.

The bending of the tube and the drilling of the spring pads are done by usual methods but the special machines used in drilling for the forks which carry the steering pin are unusual, as shown in Fig. 1. The axle is located by the spring pad at *A* and the forked end is positioned by the steering pin hole at *B*.

The drilling head carries four spindles all driven by a single belt and the drills are fed into the work by means of the pilot wheel *C* acting through the rack and pinion at *D* and transmitting the feed by means of the levers and bell cranks as at *E*. After the drilling, the locating rivets are put in place and the forked ends brazed to the front axle tube. The riveting is shown in Fig. 2. where the tube is held in special vise jaws and the rivets driven by the air hammer *A*, while the plugs *B* act as holders-on.

The assembling of the front axle requires considerable care if good results are to be secured. The assem-

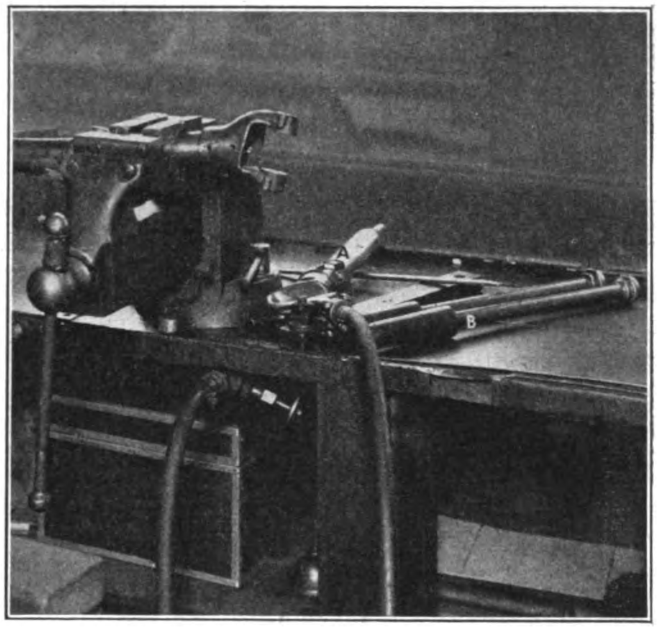


FIG. 2—RIVETING FORK BEFORE BRAZING

bling fixture, shown in Fig. 3, is very complete and takes care of the steering knuckles as well as the spring mounting. The forked ends are located by the plug *A*, which represents the steering pin and holds the knuckle in place. The full elliptical springs are posi-

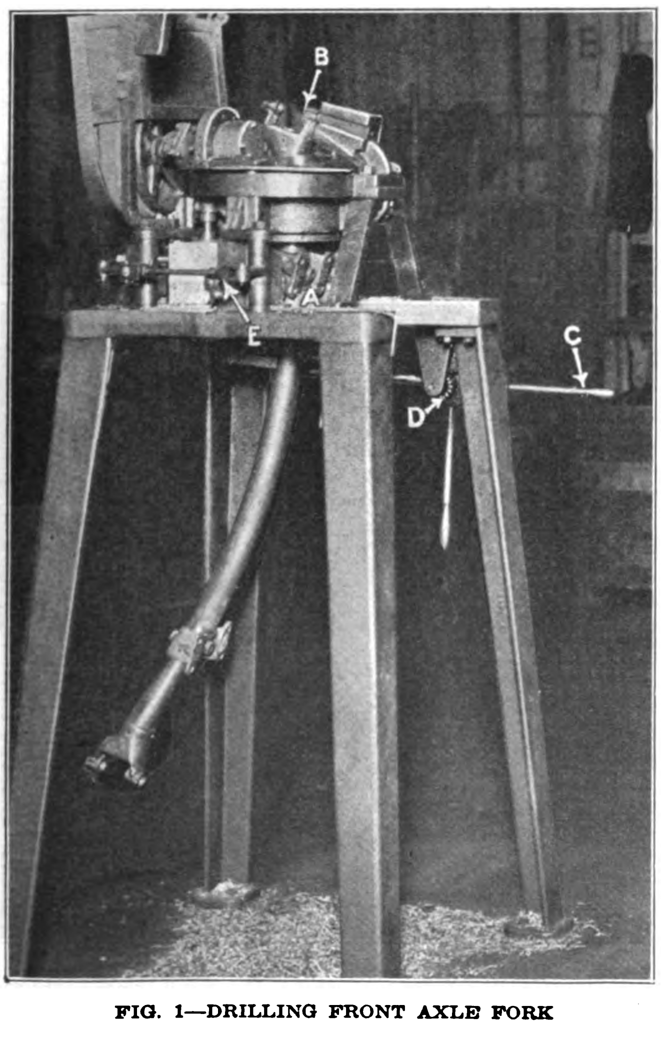


FIG. 1—DRILLING FRONT AXLE FORK

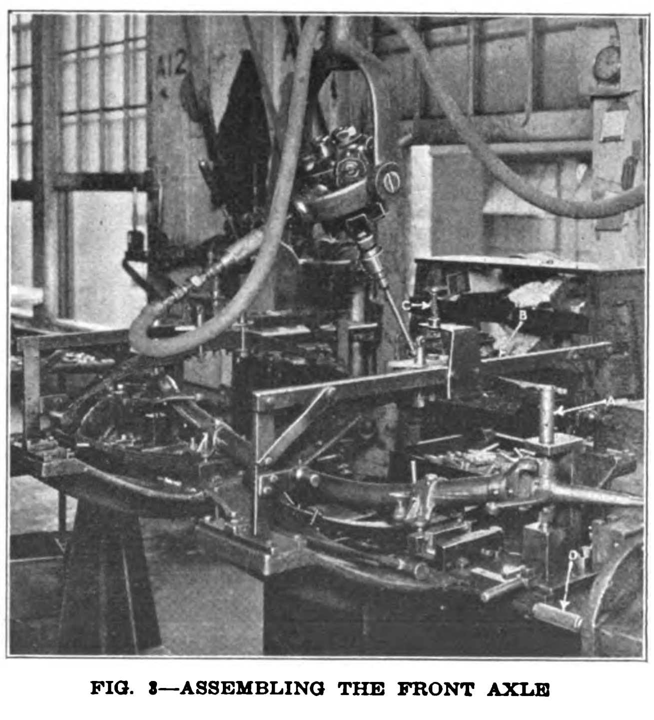
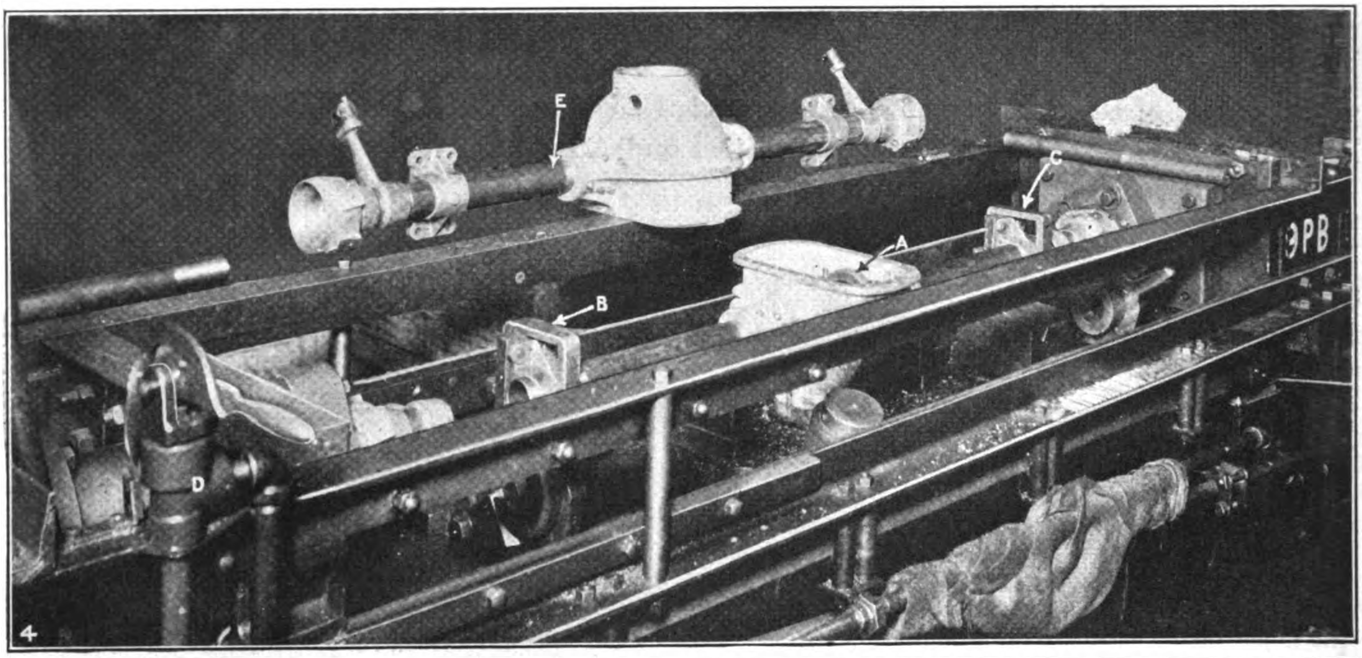
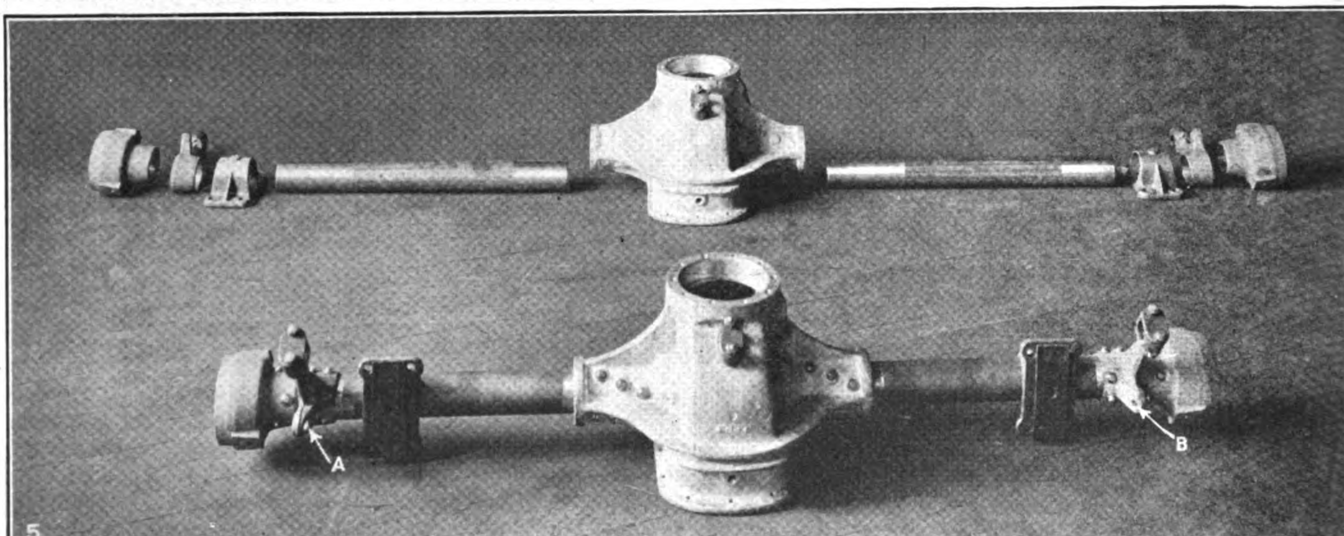


FIG. 3—ASSEMBLING THE FRONT AXLE





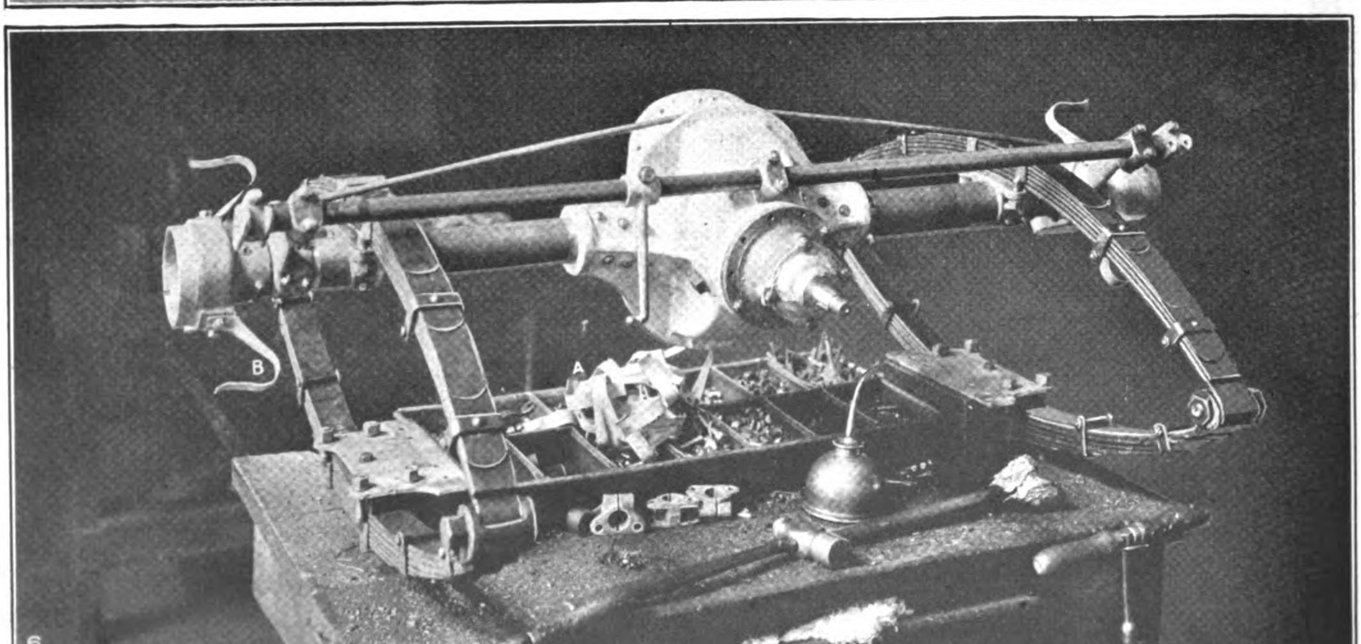


FIG. 4—FORCING REAR AXLE HOUSING PARTS TOGETHER. FIG. 5—REAR AXLE PARTS AND AN ASSEMBLED AXLE. FIG. 6—ASSEMBLING THE REAR AXLE

tioned by the framework *B*. This fixture allows the easy assembling of the top and bottom spring clips, the lower connection being underslung, as can be seen. The upper spring connections are located by the spring plunger at *C*. The projections above the spring are for fastening the springs to the wooden frame which connects the two axles and on which the body rests. The whole fixture is trunnioned on two pedestals so that it can be turned in any convenient position. The indexing pin is shown at *D*. The nuts are screwed into place by an air drill provided with a friction chuck.

The Rear Axle

The Franklin rear axle is also out of the ordinary, as can be seen from its construction in Fig. 4. It is one of the few rear axles made with an aluminum differential case in order to reduce unsprung weight. Into each end of this central casting a steel tube is forced before the final assembly. The press, Fig. 4, forces on the spring pads and the outer castings which carry the rear wheel bearings.

The differential aluminum casting with the tubes already riveted in is first put in the press and a spacing piece, *A*, put in between the walls of the case to prevent distortion while the tubes are being pressed into position. Screw flanges adjust this spacing block and allow it to be easily put in and removed.

The spring pads are placed over dowels *B* and *C* in the fixture and the end pieces located in the two rams at the ends. The valve *D* controls the hydraulic pressure which forces the heads toward the center and with them the various parts which go to make up the rear axle housing. The completed housing is shown at *E* and also very clearly in Fig. 5, including the leather cushions riveted to the spring pads.

The complete rear axle assembly is shown in Fig. 6. Here the drive shaft pinion is in place as well as the brake rigging. The upper spring connection for the frame is shown at the bottom, the axle being upside down with the frame plates resting on blocks on the bench. The tray on the bench contains all necessary nuts, bolts and cotter pins. A small pile of the springs used to keep the brake band away from the drum may be seen at *A* and in place at *B*. This view also shows the truss rod which runs under the differential case and which is anchored at *A* and *B*, Fig. 5.

Personal Records

By A. W. Brown

A card index "Who's Who" should be kept by every manufacturing establishment, giving information concerning each member of the working force from the Grand Panjandrum down. The index should give not merely the usual memos about age, family circumstances, etc., but data concerning temperament, and physical, mental and moral qualities. In other words, the worker should be "sized up" so that if the time comes for laying off men on the one hand, or transferring or promoting on the other, the man's record as to what he can do and cannot do, and what he probably could do and could not do, will enable sane and mutually satisfactory action without great delay. Wages from the beginning of employment, through successive increases or decreases should be entered, with the reason for each change.

Needless to remark, these records should be open for inspection only to certain duly appointed persons, in no case to any of the workers.

A Trial Drill that Made Good

By I. B. Rich

A local salesman had left a new kind of drill for trial in a shop on his "beat" and in due course of time he dropped in to see how it was working out. It wasn't one of these "red-tapy" shops where the salesman sees only the P. A. and the P. A. tells the super and the super tells the general foreman, etc. It was a direct action shop, and the salesman had the confidence of the management to the extent of being able to go straight to the man using the drill.

But the man saw him coming—made a few mysterious passes at the drill spindle and beat it. Pretty soon he came back empty handed.

"How's the drill working, Bill?"

"Fine, don't see how it could be better. Have you come after it?"

"No, Bill, just wanted to see how it worked."

"S'all right then—I'll go get it. Saw you coming, so I hid it—thought you wanted it."

The salesman didn't need to be told how to use this recommendation for his drill.

Sauce for the Goose Is Sauce for the Gander

By Entropy

Draw a circle with a radius of five hundred miles with the office of *American Machinist* as a center, and it will just about pass through a shop that I saw a few days ago where awnings were hung alike over shop windows and office windows. It was such an odd circumstance that I was quite amazed. It has long been the custom to assume that the office force needed awnings on the sunny side and that the shop force did not. From my personal acquaintance I have judged that from a purely physical point of view it may be that the average office worker is less able to withstand heat and cold than the average shop worker, but as a matter of profit and loss to the company I have wondered if there would not be more profit per awning if they were put over shop windows than over office windows.

Of course an awning does not do much good in the middle of the day because then the sun is nearly overhead during the awning season, but on the east side in the morning and on the west toward night there is a good deal of superfluous sunlight coming in. This is either when men are starting the day's work and need to conserve their strength to get through the day, or when they are finishing the day's work and will soldier on the job to get through it with the least effort if they are already tired.

Awnings on the south side, where most put them, are more ornamental than useful. Shop men get tired, they are affected by the heat and they have just as many ways of appearing to keep busy without working hard as do office workers. The profits of the company are much more affected by this slowing down of a shop man than they are by the corresponding slowing down of the office, moreover the shop usually starts work earlier and quits later than the office.

I have sometimes wondered if the managers of these shops did not put up awnings for the offices because they were so ashamed of the rates they pay their clerks that they felt that they must do something to make up this deficiency to them. Perhaps like the fleas on David Harum's dog, the awnings help to keep their minds off their being clerks.

Ideas from Practical Men

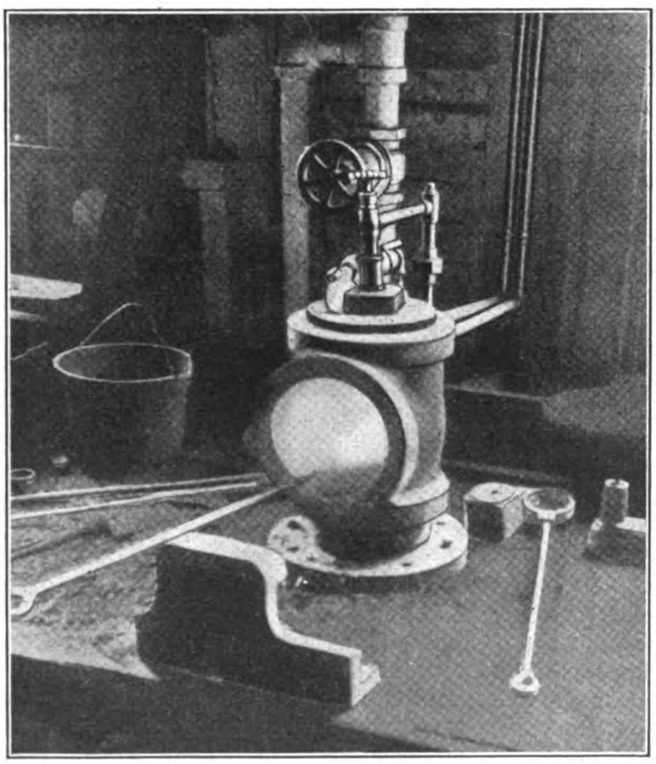
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Small Heating Furnace from Scrap Material

By Milton Wright

A furnace in which to heat small dies and other tools for hardening, to melt small quantities of babbitt, for soldering or any of the numerous purposes for which such a furnace is needed about the average machine shop, is here shown. It is made from scrap materials. The body of the furnace is a 4-in. pipe tee that had been discarded because of a crack. A flange and short nipple furnish the base, the nipple being filled with fire clay up to the level of the side outlet of the tee. A plug which is tapped for the burner, closes the top of the tee, and the burner is made from such odd fittings as may always be found around a shop where pipe is used.

The construction of the burner is apparent from the picture. The gas is admitted to the side outlet of the ¾-in. tee while the upper outlet or "run" of the tee is reduced to take the ⅜-in. air jet pipe. The whole outfit can be put together in a few minutes in most any



A HOME-MADE SMALL FURNACE

general machine jobbing shop from material that would otherwise be considered as scrap. None of the joints need be tight and therefore fittings that are distorted or have damaged threads may be used. The size of the air jet would depend somewhat upon the pressure of the supply. The illustration shows the furnace under fire with a ladle of babbitt being melted.

A Handy Boring Machine Attachment

By W. J. Winston

The use of the fixture shown in the photograph, Fig. 1, on the faceplate of a Landis horizontal boring machine, makes it possible to perform several operations that formerly required the services of a planer, lathe and radial drilling machine and has eliminated

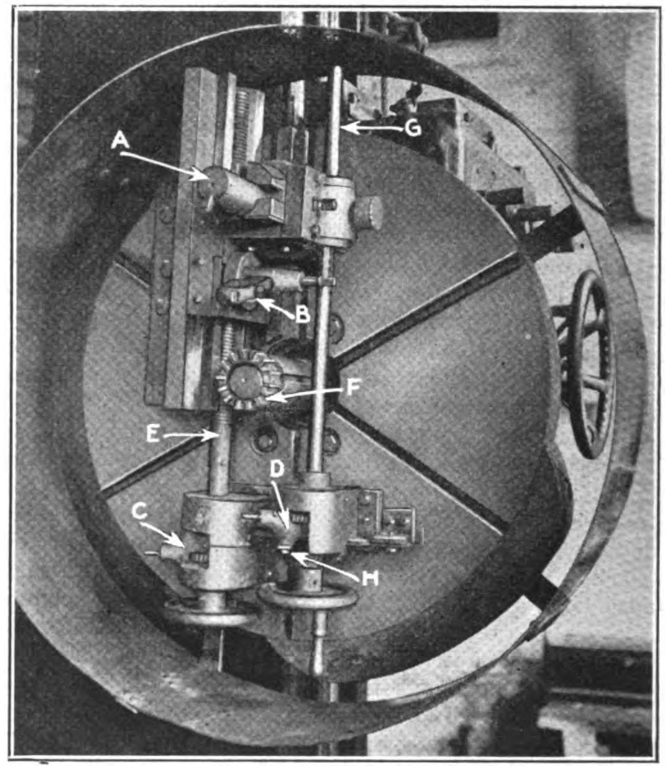


FIG. 1—ATTACHMENT ON BORING MACHINE FACEPLATE

the time and cost of handling the casting between operations.

The casting, a machine frame, is shown in Fig. 2 in the position in which it is placed on the table of

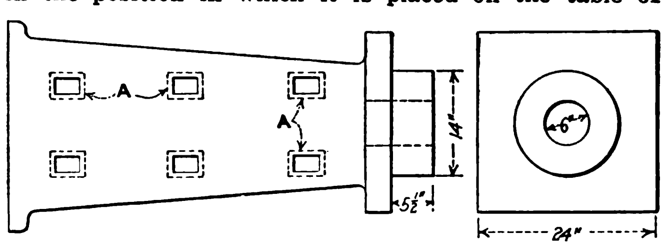


FIG. 2—MACHINE FRAME

the machine. In the first operation, the machine-table is turned so that the side of the frame faces the head of the machine and the inner faces of the bearings *A* are milled off, using a four-inch cutter, shown at *F*, Fig. 1. Then the table is turned to bring the top of

the casting to the head of the machine and the six-inch hole is machined, using a cutter in the spindle *F*, while at the same time the tool *A* is turning the outside of the hub. Then the face of the square and the end of the hub are faced simultaneously, using the cutters *A* and *B*.

When used for turning, the feeding of tool *A* is effected as follows: Shaft *G* passes through a worm that meshes with worm-gear which has a square thread cut through the hub. The tool-bar *A* has a corresponding thread cut on the outside and thus serves as a shaft for the gear. When shaft *G* is turned, the worm gear is revolved and the bar is fed forward. A keyway, cut the whole length of the bar, slides on keys in the worm gear housing and keeps the bar from turning.

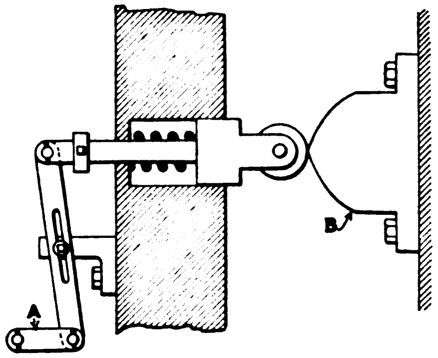


FIG. 3—AUTOMATIC FEED MECHANISM

When ready to perform the facing operation, tool *A* is set the correct distance from tool *B*, and the two tools are fed across the work by the operation of the screw *E*, which passes through a nut on the bottom of each of the tool posts.

Screw *E* and shaft *G* each passes through a gear located at the lower end of the shaft, just above the hand wheel, and connected with each gear is a ratchet of the usual design. Attached to the ratchet at point *H* is the connection *A*, Fig. 3. Through an intermediate lever, this connection operates a push-rod which carries a hardened and ground steel roller. The push-rod operates through a hole in the face plate of the machine, as shown in Fig. 3. A hardened steel block, *B*, is bolted to the column of the machine in such a position that the roller passes over it with every revolution of the face plate, thus operating the ratchet and feeding the tool. The intermediate lever is slotted so that it can be shifted to change the feed.

Formula for Tap Drill Size—Discussion

By Wm. S. Rowell

I wish to refer to recent contributions in the *American Machinist* under the above head by J. R. Owens, on page 935, Vol. 56, and H. W. Bearce on page 310, Vol. 57. Possibly a little further consideration of this subject may not be overdoing it. The rule: Tap drill = Nominal tap size — $2d$, (d = depth of thread) may be departed from only where less than a full thread is permissible. Doubtless modesty prevented the editor from pointing out that Mr. Owens' variant has appeared in more than one edition of the *American Machinists'* Handbook, and may be found on page 62 of the third and current edition, where it appears with a caution. It is only a rough approximation, giving about 76 per cent of a full thread. Though reasons may be given for the use of such threads, it is well to understand their limitations, and especially to know when we are producing them. The percentage of full thread permissible or advisable in any specific case depends on many factors, including not only service required, but material used, length of thread in relation to diameter, and so forth.

A little examination of the subject will show that the rule under consideration: Tap drill = nominal size $-\frac{1}{p}$, (p = number of threads per inch), would be right if $2d = \frac{1}{p}$; but even in the shortened U.S.F., and similar threads, $2d = \frac{1+0.3}{p}$, very nearly. To be more exact $2d = \frac{1+0.2990375}{p}$. For convenience the less than 0.001 may be neglected, and double the depth of U.S.F. threads ($2d$) may be considered, $\frac{1.3}{p}$. Those who are especially interested in reducing power consumption and breakage in tapping operations are inclined to urge the advantages of a shallow thread; but so mony considerations enter into the problem of proper thread depth that most designers and users of taps prefer to decide each case on its own needs.

A rule for quickly and easily approximating tap drill sizes for any U.S.F. tap is: Tap drill = nominal tap size less $\frac{1.3}{p}$. This rule is submitted after use extending over many years. It also "has never been seen in print" nor has it been found in use by the writer. It may appear to some that 1.3 is an inconvenient mixed-number to use as a dividend; but most of that disappears when reduced to $\frac{1,300}{1,000}$. It is always considered either $\frac{13}{10}$, $\frac{130}{100}$ or $\frac{1,300}{1,000}$; usually the latter, as most of our dimensions are in thousandths. A pencil is never used in the calculation, the mental process being something like this: Take a $\frac{3}{4}$-in. 10-thread tap drill:

$$1,300 \div 10 = 0.130$$

Nominal size = 0.750 in. — 0.130 in. = 0.620 in. = aproximately $\frac{5}{8}$ in.

It is instantly seen that $\frac{5}{8}$ in. is slightly large but as generally agreed we rarely need a *full* thread. This is an easy one. Now for one that may look less so. A one-inch 8-thread tap drill = 1,300 ÷ 8 = 0.1625

Nominal size 1 in. — 0.1625 in. = 0.8375 in. = $\frac{27}{32}$ in. approximately.

Here again in selecting a $\frac{27}{32}$-in. drill we are sacrificing a small amount of thread depth.

Even in the case of a fractional thread a pencil is scarcely needed in the simple calculation

Example, 5 in. $2\frac{1}{2}$ threads.

$$1,300 \div 2\tfrac{1}{2} = 0.520$$

Nominal size 5 in. — 0.520 in. = 4.480 in.

It is readily seen that the only noval feature of this rule is considering the constant 1.2990375 as 1.3 and this as thirteen-tenths or a hundred and thirty hundredths or thirteen hundred thousandths, preferably the latter as so much of our work is dimensioned in thousandths that we all become more or less familiar with that tiresome translation of binary and other vulgar fractions into their nearest equivalents in three places of decimals. The burden of ten as a radix is one that man may never escape. May it be considered evidence of a slight oversight in the original design, starting him out with ten digits instead of eight, or better, twelve?

String Board Graphics—Discussion

By H. E. Taylor
Chief Engineer, Hotchkiss & Co., Coventry, England

The contribution of Percy S. Brown on string board graphics which appeared on page 483, Vol. 56, of *American Machinist*, has been read with interest.

Visual recording in its works has been adopted successfully by Hotchkiss & Co. As the string graphs have been in operation for nearly three years, a few remarks on the details of their application to the progress section may be of timely interest.

The boards used, a sample of which is shown in Fig. 1, are of simple, cheap construction, standard as to size and painted black. The titles and borders are carried out in white enamel, and light green paint is used in dividing the board into squares.

The names of the components with their corresponding drawing numbers are painted on black enameled strip plates. Each plate is drilled at the ends and can be hung on two nails provided on the board for this purpose. These plates were adopted to enable alterations to be made quickly. In the center of each square, a short brass nail is driven, and around these pegs the string is carried as shown in the illustration.

Various colored strings are used. A red string stretched from the top to the bottom of the board, shown by the dash line, is used to indicate the nominal stock which should be carried. The actual stock in the stores is indicated by a white string. A yellow string is used to show the number of parts actually passing through the shops at the time the boards were last made up.

To the extreme left of each board, a strip of paper is carried on "bulldog" clips. Upon this strip of paper, each time the boards are made up, is entered the number or quantity by which any component falls short of the nominal stock quantity previously arranged. In the case

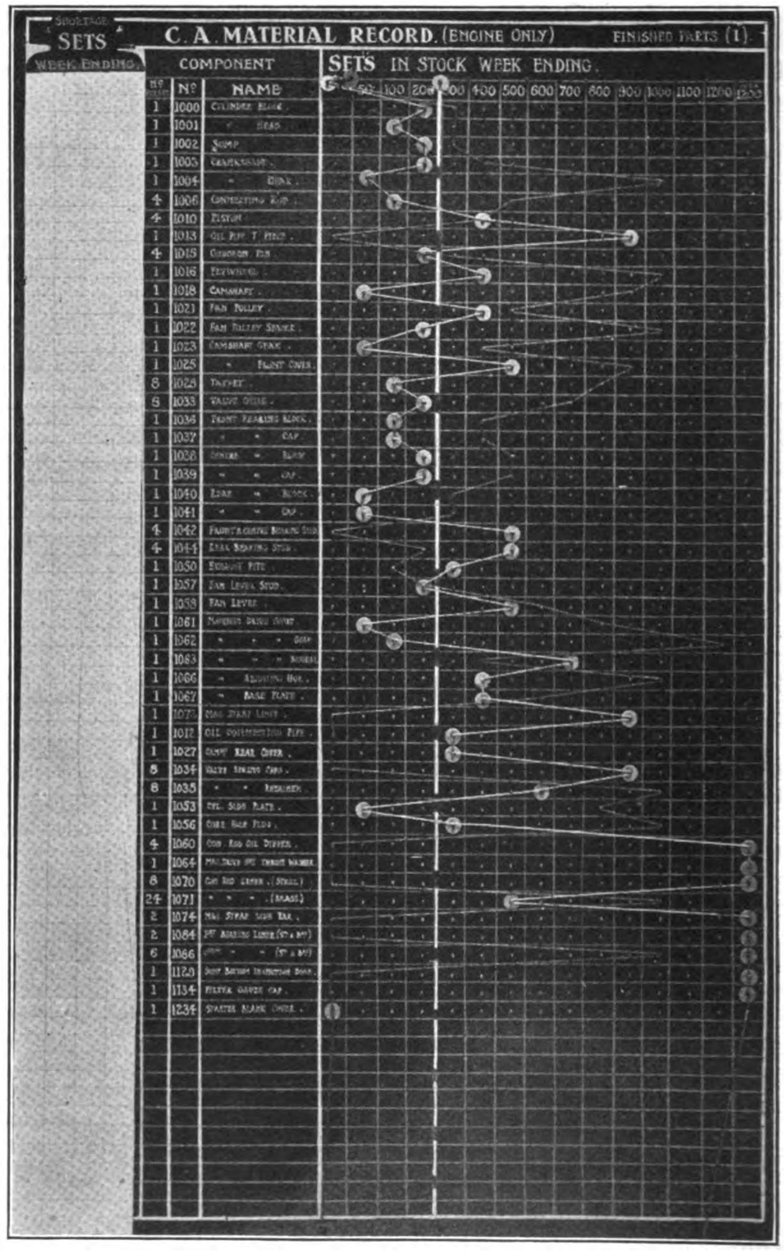


FIG. 1—STYLE OF BOARD USED, STRING GRAPHS IN POSITION

FIG. 2—STRING BOARDS IN OPERATION IN FINISHED STOCKROOM

of a shortage, therefore, the department concerned understands that it should endeavor to make up the quantity lacking before the boards are brought up to date again.

Three sets of boards are used. One gives the position of the raw material stock. The second board shows the parts purchased from outside sources in a completely finished condition; and the third board, by means of different colored strings, indicates not only the quantity of finished parts actually on hand in stores, but shows details pertaining to the progress of parts in manufacture in the shops.

The boards are brought up to date weekly. The "rough storekeeper" is responsible for the raw material records, and the progress department for parts passing through the shop. The "finished storekeeper" is responsible for parts bought outside, as well as finished stock. In cases where any component or part requires special attention, metal stars are used, and these are hung on the pins around which the strings are carried. In Fig. 2 a number of the boards are shown in operation in the finished stores department.

Automatic Machines for Small Brass Gear Blanks

By Herbert Crawford

The Neptune Meter Co. uses many small brass gears in the recording mechanism of its meters, and the two machines shown herewith have been rigged up especially for machining the blanks. The first is a small, special automatic machine, shown in Fig. 1, for turning the outsides. The castings are dumped into the hopper and slide down against the feeding disk *A*, which revolves slowly. The slots in the face pick up the castings and the outer piece in each slot drops through a chute at *B* to the feeding plunger *C*. The two holes to be seen in the gear blanks fit over corresponding pins on the plunger which hold them against turning, while the plunger feeds the blanks into a hollow mill which turns the outside. With the withdrawal of the plunger the finished piece drops out of the way and another takes its place. The machine requires no attention except to fill the hopper.

The second operation is performed on a Brown & Sharpe automatic screw machine, as shown in Fig. 2. The turned blanks are fed into the S-shaped magazine and roll down into the receiving head *A*. The tool *B* pushes them into the chuck by means of the plunger *C*. While the turret is turning, the rear cross slide with the plunger *C* is drawn back out of the way and the drills in the turret get to work. The center hole is drilled and reamed and the side faced by the front tool carriage, after which the piece is ejected from the chuck and a new piece fed into place.

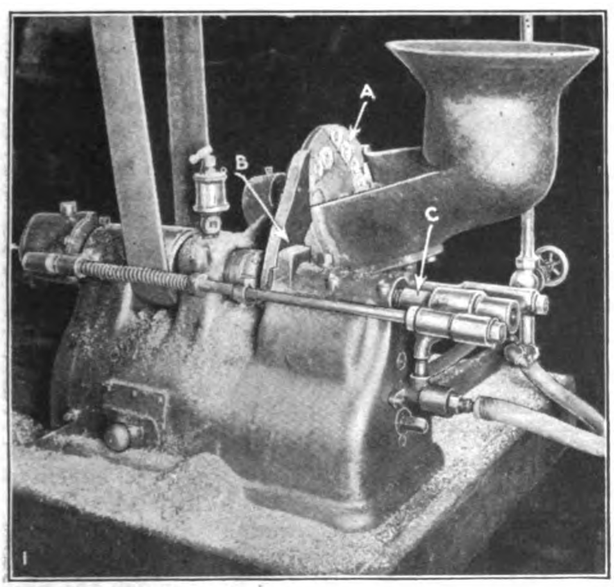
Another evidence of the way in which dial indicators are used can be seen at the left of the cross slide. These indicators are mounted in various ways so as to be convenient for the operator to test as many pieces as may be necessary as they come from the machine.

The Mechanics of Drafting

By V. P. Mendenhall

While a draftsman is not judged solely by the quantity of his output, there are certain mechanics of the profession which can be arranged to shorten the time consumed in detailing and allow more opportunity for the draftsman's training, experience, and other factors of ability to assert themselves. In making an assembly, or construction drawing there is very little opportunity for short cuts. The group assembly method, however, has many advantages on all but the simplest machines. When each unit is treated separately, the drawing can be made on a larger scale, there is not so much hidden mechanism, the sheet does not become so soiled, alterations do not affect details already approved, and, if desired, more than one draftsman can work on the same design.

With an accurate assembly, the following method of detailing will be found productive: The standard detail sheet is printed on the dull side of the tracing cloth. A backing sheet of detail paper is put on the board and the sheet outline, block divisions guide lines for such lettering as symbol, material, and number required, are printed in pencil. The tracing sheets are laid on this backing sheet one at a time, dull side up, the details outlined with a soft pencil and immediately inked in. The block outlines help to place the drawing, and the division lines are inked in as necessary to



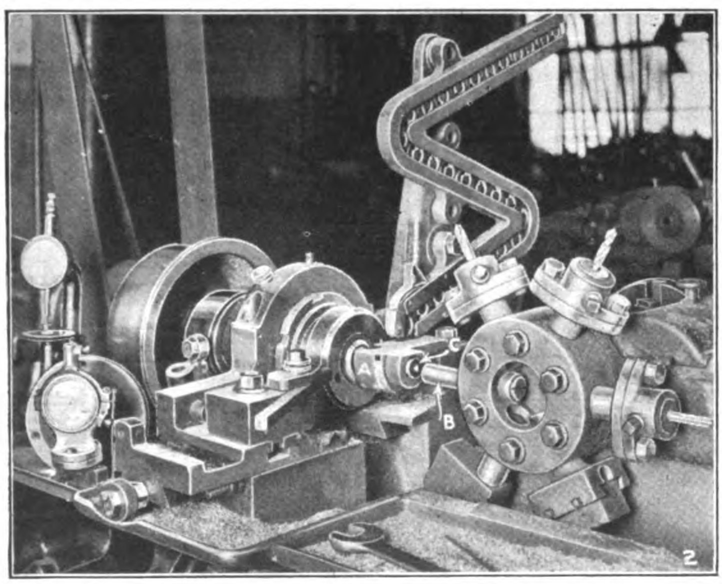


FIG. 1—SMALL AUTOMATIC MACHINE WITH HOPPER FEED. FIG. 2—MAGAZINE FEED ON BROWN & SHARPE AUTOMATIC SCREW MACHINE

enclose each detail. The sheet is then cleaned with gasoline. A draftsman who is accustomed to think ahead of his hands can show a noticeable increase in the work accomplished by this plan, especially if he is provided with a drafting machine.

One view will suffice for most of the studs and pins, as well as for flat plain work if the thickness is given in a note. Gears, pulleys, rollers, and bushings need only a cross-section. A left hand view or symetrical half can often be traced from the right hand printed face down. Fits should be given in thousandths. In the shop $(1\frac{5}{8})^{+2\text{ to }2\frac{1}{2}}$ will prove a great time saver over $(1\frac{5}{8})^{D}$. For springs, the size of stock, mandrel and turns per inch should be given.

A great aid to the production clerk is a parts list of each machine giving the symbol, part number, sheet, number required, material and stock needed, and in what shape, that is, cut up, or in bar form for turret lathes and screw machines. Stock patterns for bushings are also noted. In addition, the assembly will be greatly accelerated by a bolt and screw list, including all the parts to be drawn from the supply room. Such lists will insure that the different parts and materials are ordered well in advance of assembly, and will go far towards standardizing methods of production.

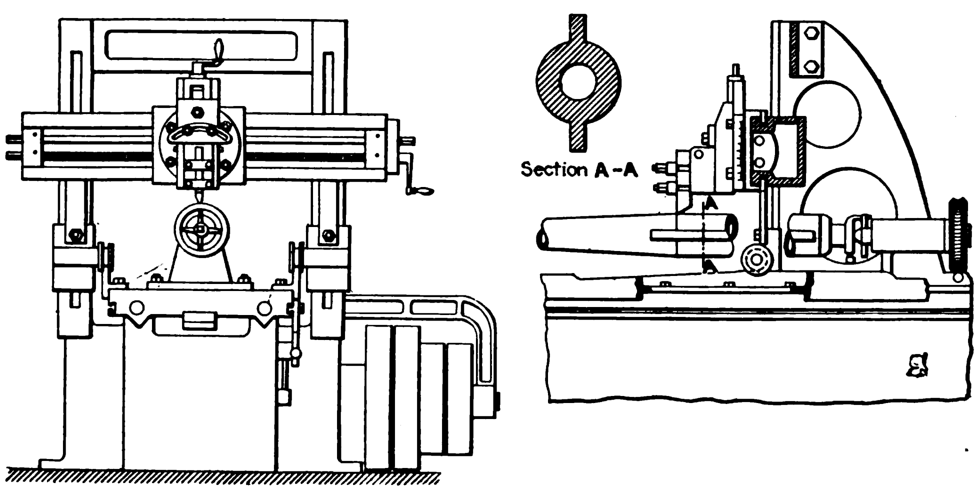
Planing Irregular Surfaces

By Joe V. Romig

Work having complicated surfaces—circular and flat, having more than one plane, or having a flat surface merging into a long taper or radius—can be machined on the planer by means of the simple equipment here described. The use of formers for producing multi-surfaced rounds in the lathe is common but the attachment of a forming device to a planer is unusual.

The example shown is that of a light cannon having on each side a parallel rib or shear forged in one piece with the jacket. The shears are for the purpose of mounting the cannon in the housing in such manner as to permit it to move endwise, and are a part of the recoil absorbing mechanism.

The body of the gun is round, parallel over a part of its length and tapered the rest of the way. To finish this surface by turning would have been impossible, as a glance at the section A-A will readily disclose. The forging was machined upon a planer in the manner herein described.



SET UP FOR PLANING IRREGULAR SURFACE

Cast-iron former bars of T-sections were made as may be seen in the sketch, and one of the internal angles planed on each so as to allow the bars to be bolted rigidly to the table. One edge of one of the T-s was then laid out to conform to the contour of the finished gun, and both were planed by bolting together, gripping them in the shaper vise and planing crosswise. Several hitches were necessary to complete the long bars but no real difficulty was encountered in following the line.

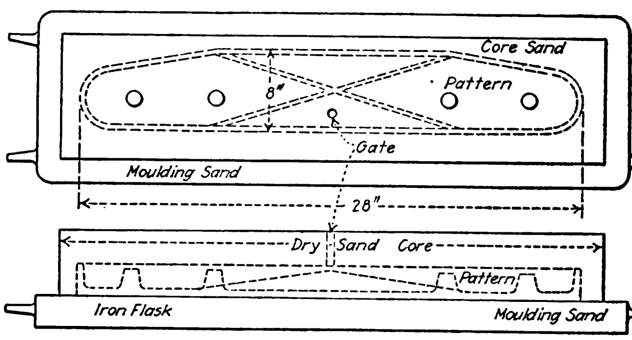
The former bars were then bolted to opposite sides of the planer table. Slides, each carrying a guiding roller, were fitted to the face of the planer housings and attached to the crossrail by suitable straps. The elevating screws were removed to allow the crossrail to rise and fall as the rollers traveled over their respective formers.

A pair of centers to take the work completed the set-up and the work of machining was simple and easy of accomplishment.

Making a Straight Casting from a Twisted Pattern

By M. E. Duggan

Dan Mulligan had money and was looking around for an easy way to get rid of it, so I advised him to try inventing. He did—and proved that this long-advertised method was not always successful. Dan



A GOOD CASTING FROM A POOR PATTERN

invented a machine for taking the wrinkles out of trousers. Being a novice in the art of spending money he could not grasp the idea of paying out enough all at once to get a good set of patterns for his experimental machine so he compromised by having a "good enough" set made, from which he obtained the castings for one machine. The patterns were then "parked" next to the roof of the pattern loft where the boiling sun poured down day by day—unless it rained, when the roof leaked a little. No further attention was paid to the patterns, however.

The first machine was an astonishing success, much to everybody's surprise, and Dan immediately ordered castings for six more, but alas! those patterns from which the first set were made so nicely were

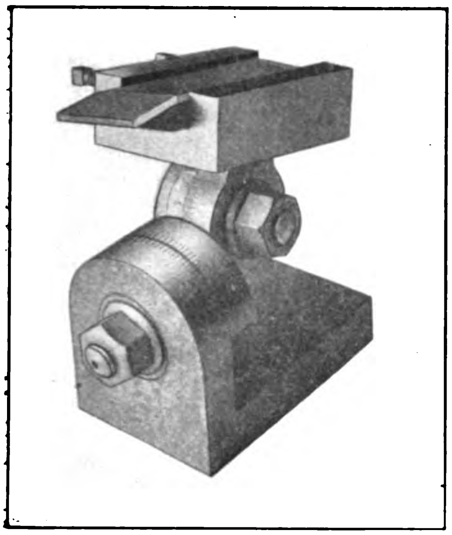
no longer in condition to produce others of like degree, for they were warped, twisted and some of them broken beyond repair. One of the castings was for a sort of steam table and required a true flat surface, for the finish was by grinding and there was no stock to be machined off. Here is the way we made a good casting from that twisted pattern.

The pattern was laid face down on the core bench and a rough frame of wood nailed around it as a sort of temporary flask. This was filled with core sand and, when ready, this "core" was put into the oven and baked. An iron flask of suitable size was then provided and partly filled with molding sand, rammed down good and hard and the surface swept off level and smooth. On this bed of molding sand the "core" was laid, still face down, and weighted. The iron was poured through a hole or gate that had been made in the core, and a good casting resulted, the upper face (which was at the bottom of the mold) being produced by the smooth bed of molding sand. The cut will make the procedure plain.

An Angle Grinding Fixture

By Henry M. Clary

The fixture shown in the photograph was designed for the purpose of holding tools similar to the one shown in the illustration while they were being shaped and ground. It has, however, been found very useful for grinding angles on all sorts of work. The fixture is very simple, consisting of three parts bolted together. The surfaces at the joints are ground even and graduated in degrees, so that a piece of work can be set at the exact angle desired, in either direction. Two setscrews in the head hold the piece in position. The fixture is in use in the shops of the Midwestern Tool Co., Chicago, Ill.



AN ANGLE GRINDING FIXTURE

Safeguarding Shaft Couplings

By Wm. J. Fisher

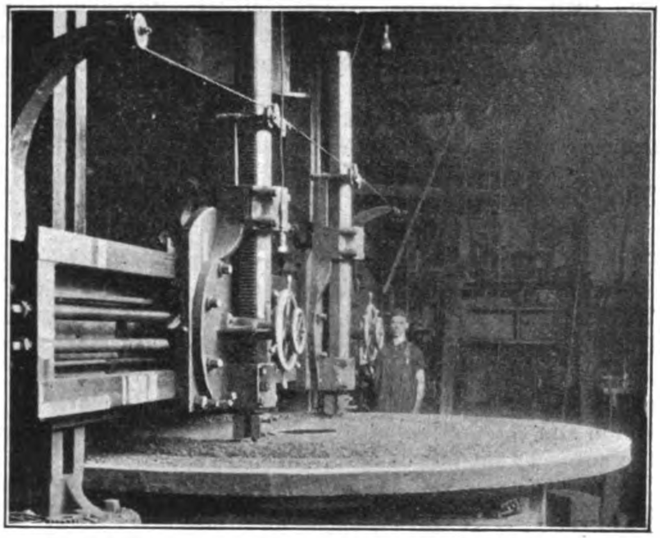
I was interested in an article by E. Hoke, on page 75 of *American Machinist*, on safeguarding shaft couplings. As I am interested in all safety appliances I read it over very carefully.

I cannot understand how the coupling could get by the inspector with that wicked looking gib-key standing out beyond the hub where it would surely catch anything more quickly than the bolt heads and nuts. Why should the key not have been fitted up from the inside, or flange end, of the coupling and cut off flush with the outside hub?

A Single Casting That Is in Two Parts

By Sandy Copeland

There is nothing unusual about the job or the casting shown in the illustration except in the way in which the latter is poured so that it may be machined as a single casting and shipped in two pieces. The piece is a "rubbing bed" used for surfacing large blocks of stone, and when mounted upon the machine for service it is bolted to a spider that is in turn keyed upon the end of a vertical shaft so that the disk revolves in a horizontal plane, just as it does on the boring mill only considerably faster.



A SINGLE CASTING MADE IN TWO PARTS

The finished disk is 13 ft. in diameter by about 3 in. thick and the casting weighs 10,800 lb., about 800 lb. being removed by the tools. As shown upon the table of the mill there are two tools at work, each taking a cut ¾ in. deep with a 3/32-in. feed. When the mold in which it is to be cast is finished, and before lowering the cope to place, a wrought iron bar of rectangular section is laid across the diameter of the mold. This bar is ½ in. thick and of a width equal to the thickness of the casting. It has six or eight 1½ in. holes through it and is laid edgewise in the mold.

Binding the Parts Together

After closing the mold the iron is poured from both sides simultaneously, the molten metal passing through the holes in the bar and serving to bind the two parts together in a single casting strong enough to withstand any shocks that may be imposed by ordinary handling or in the machining operations. When the disk is finished it is mounted upon the spider and fastened thereto by bolts passing up through the spider and tapped into the under side of the disk. After assembling the machine and making sure that every thing is in shape to run, it is dismantled for shipment.

The disk, which thus far has remained a single casting, is then picked up by the yard crane and dropped upon a timber laid upon the ground lengthwise of the joint. One drop from a height of but a few inches is usually sufficient to break the casting. Upon reaching its destination the disk is reassembled in the machine, the bolts passing through the holes to which they were numbered in the original assembly, and the disk runs as true and smooth as when it came off the boring mill.

Editorial

THERE ARE several very important facts about tools that everyone should know, among them three that can and should be proclaimed from the housetops by the men who have learned them through sad experience, for there are still many who do not know them. Machine tools are an asset; small tools are an expense; improper tools are a liability.

Shall We Cancel the War Debts?

TWO NOTABLE contributions to the best thought on the problem of liquidating the debts of the World War were made at the banker's convention last week. Rt. Hon. Reginald McKenna, former British Chancellor of the Exchequer and a noted banker and economist, gave a picture of the situation which rivals in clarity of vision and conciseness of expression any presentation of the subject that has come to our notice.

Mr. Lamont of J. P. Morgan & Co., as one of the foremost American financiers, introduced a more idealistic tone into his address but showed that he has the same keen appreciation of the fundamental problems of inter-allied indebtedness and the reparation indemnities as has Mr. McKenna. He asked many questions and answered some of them by inference only, but in a way that left little doubt as to his personal feelings.

One question, perhaps the most vital one, was this: Should any part of the debt of the allies be cancelled by the American taxpayers? In seeking an answer to this question more than one phase must be considered if the result is to be sound and lasting. Altruism cannot overlook hard economic facts, and political expediency must respect moral principles. The question is so complicated that a hasty answer is inconceivable.

Mr. Lamont says the question of cancelling part of Europe's debt to us must be answered by the taxpayers. What, then, will be the answer of the makers and users of machinery? If they concede that Mr. McKenna is correct in saying that the debts can be paid by exportable surplus only, and they must concede it eventually, most of the available gold and securities being already in our hands, are they not faced with the choice of either agreeing to the cancellation of part of the debt or acceptng payment in machine tools, printing presses, looms and other machinery?

As a matter of fact it seems likely to be something of a Hobson's choice, for, of all the countries of Europe that are in our debt, England is the only one which has the slightest chance of meeting either interest or principal payments, at least within the immediate future.

We Americans would be the last people in the world to doubt the good intentions of our debtors to repay in full, but the laws of economics make small allowance for the best intentions. Until the number of unbalanced national budgets is considerably reduced, we as creditors must discount good intentions about ninety-nine per cent.

Not a few believe that cancellation of all debts of European nations to the United States would make for a rapid return to prosperity for all concerned. They use the argument that so long as we shall probably never be paid anyway, we might as well make the best of a bad matter and start afresh. Others insist that the debits be kept on the books until some means of payment is found. Some of them refuse to believe that Europe is not hiding her resources and is not attempting to "do" us.

We believe that both camps of extremists are wrong and that both ignore basic facts. Those who favor cancellation forget that the mistakes of the Peace Conference have left many sore spots in Europe that are likely to break out if the threat of insolvency is removed. The suspicious and practical souls, on the other hand, are shutting their eyes to the unbalanced budgets, depreciated curriencies, unemployment, lack of capital and raw materials and disorganized industries, some or all of which afflict our debtors.

But isn't there a middle ground that America can take with some hope of improving the situation? Can she not charge off part of this indebtness in return for the protection afforded her in the year she took to raise and train her armies, but at the same time insist on holding to account for the remainder those of her debtors who would be likely to start new wars on the money they owe us.

Just what part should be cancelled and what should not is a very important detail to be worked out. It would vary with different countries perhaps. Possibly some better plan will be devised. But in the light of the information now available this one seems to meet the requirements fairly well.

Just Suppose

JUST SUPPOSE all the modern machine tools should suddenly disappear, and in their place we should find the much admired museum specimen of the "good old times." What would happen?

Well, for one thing, we should have to quit riding in automobiles for they would be in the same class as seagoing steam yachts and pearl necklaces. Nor would the bicycle be within reach of any but a favored few and so we should have to huddle together in cities and say farewell to our suburban home, our vegetable garden and our flower patch. Street cars? No, not even street cars, except a few short-haul horse cars, because motors would be scarce and expensive. Besides, it would be difficult to build generating stations and transmission lines for a reasonable amount of money.

All the people engaged in the making, maintaining, selling and running of these devices would have to go back to the farm and live the simple life, for the farm would be what it used to be—without labor saving devices, or means of communication with one's fellow beings, except with the aid of old Dobbin.

Without modern machine tools we would—

Hold on, this sounds like a nightmare, and besides we have them.

Yes, but—

Just suppose.

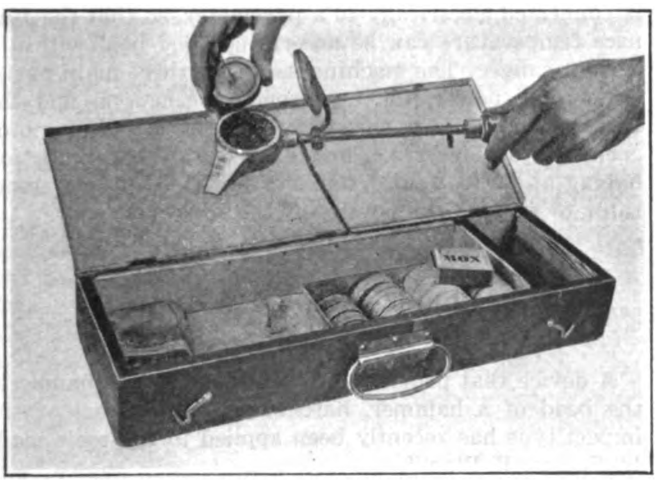
Shop Equipment News

Soldering Iron Heated by Chemical Action

A soldering iron which employs no heat from an outside source, but utilizes chemical reaction to bring it to proper temperature for use has been brought to this country by the International Sales Co., 921 Southern Building, Washington, D. C. In the use of the iron, a chemical transformation is employed by which it is possible to obtain a degree of heat of approximately 3,000 deg. C. in a few seconds. This chemical action has been so applied that by using an accurately measured quantity of the reacting substances the soldering iron can be heated in 7 sec., it it claimed, to a point where it is ready for immediate use.

The soldering iron has a receptacle cast in it, as shown in the illustration herewith. In this receptacle is placed a small tin container holding the required mixture. The head of a special match is inserted through an opening in this container, or briquet, and the wooden portion is broken off. A perforated lid is then closed over the receptacle and the protruding match-end lighted. Instantly an intense white glow appears through the holes in the lid and the iron is ready for use. The heat from this one application lasts about 10 min., after which another charge can be lighted and the operation continued. After the first heating, the duration of heat under one charge is increased 50 per cent, it is stated.

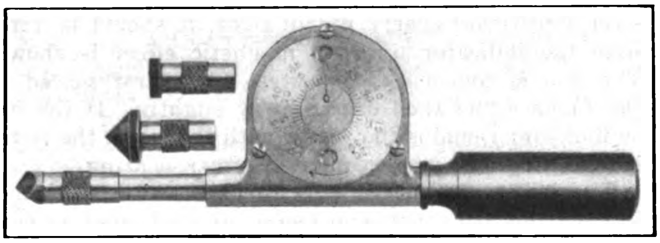
The iron and a supply of the briquets and matches are housed in a metal-lined box, with a hinged lid and handle for carrying. The charge can be set off in the box in a house or room with no danger from sparks, and practically no smoke. While in use there is no flame, but only a glowing mass within the receptable. Owing to the absence of the fire hazard, it is claimed that the iron may be used about the garage, shop or house or on an airplane, automobile, or motor boat with entire safety. The outfit is particularly useful for making quick repairs.



SOLDERING IRON HEATED BY CHEMICAL ACTION

Brown & Sharpe No. 748 Speed Indicator

The accompanying illustration shows the speed indicator No. 748 that has recently been placed on the market by the Brown & Sharpe Manufacturing Co., Providence, R. I. The indicator determines and registers the number of revolutions of shafting, motors and revolving parts in either direction, and measures both high and low speeds equally well. In design this indicator is entirely different from the former models. It has few parts, and is simple and reliable in operation. The readings are taken from one side of the indicator. The device can be quickly set at zero.



B. & S. SPEED INDICATOR NO. 748

The indicator registers up to 5,000 revolutions by steps of five revolutions, although speeds much faster than 5,000 r.p.m. can be determined. The two arrows on the face of the dial indicate the figures to use for the different directions of rotation. The figures showing through the small round windows on the dial register steps of five revolutions directly. The small inside dial registers hundreds of revolutions. This latter dial can be turned to zero by the knurled knob on the back of the indicator.

The fiber handle serves as an insulation for the operator against electricity. The working parts are enclosed in a dull-nickeled case. Three points are furnished as shown, a steel point for ordinary speeds and rubber points for high speed. All unnecessary projections, rough edges, and corners which might interfere with the use of the indicator have been eliminated. The device is light and easily handled.

Norma Minimeter

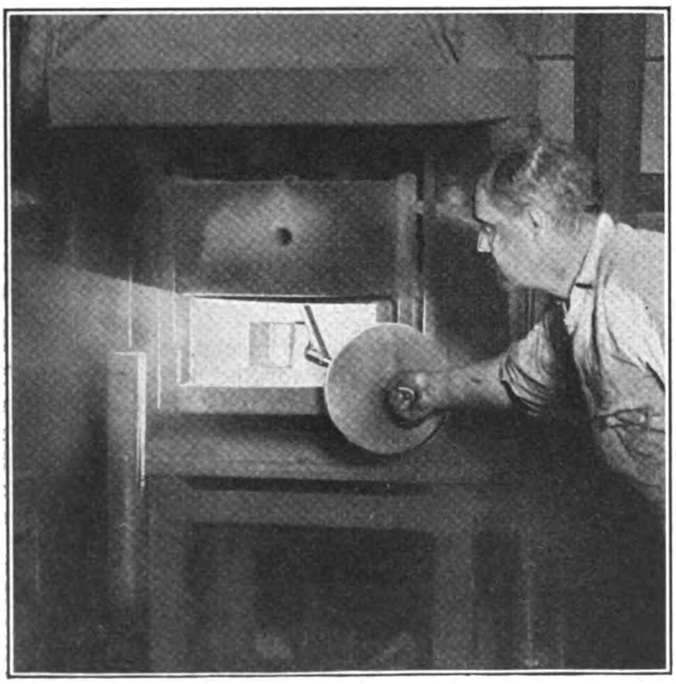
On page 861, Vol. 55 of *American Machinist* there appeared a description of the Hirth minimeter placed on the market by the Coats Machine Tool Co., New York, N. Y. The Norma Company of America, Arnable Ave., Long Island City, N. Y., is now manufacturing and selling the minimeter, which is similar in design and construction to that previously described and illustrated. The device is intended for use in gaging, and measurements as small as 0.0001 in. are commercially obtainable. The instrument can be mounted in a variety of ways to suit it to a variety of measurements, both internal and external. Either inch or millimeter dimension scales can be furnished.

Nilson Kritiscope for Determining Critical Points in Steel

A device called the Nilson Kritiscope has recently been placed on the market by Herman H. Sticht & Co., 15 Park Row, New York, N. Y., for use in determining the critical points when heat-treating steel. These points or arrests that occur while the part is being heated can be detected magnetically, as it is a property of steel to lose its magnetism as soon as the lower arrest is reached and the rearrangement of the structure occurs. Thus the Kritiscope is brought near the work in the course of heating so that the point at which the magnetism is lost can be determined.

The accompanying illustration shows the device being brought in contact with a piece of work in a furnace, but it can also be used when a small part is being heated over a flame such as a bunsen burner. As the steel approaches cherry red in color, it should be tried with the indicator until no magnetic effect is shown. The tool is touched to the steel when first placed in the furnace and then drawn away slightly. If the bar or indicator remains in contact with the work, the latter is still magnetic and requires further heating.

The indicator that actually touches the heated piece is itself not a magnet, and hence can be heated without injury. This indicator receives its magnetization by induction from a permanent magnet located within the body of the Kritiscope. The walls of the body protect the magnet from over-heating, so that it always retains its magnetism. The Kritiscope is packed in a wooden



KRITISCOPE FOR DETERMINING CRITICAL POINTS

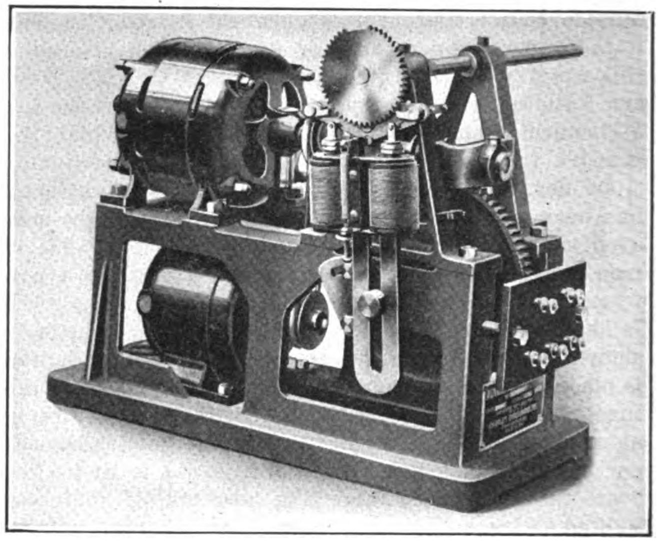
case and is furnished complete with extension rods and a shield for protecting the hand of the operator.

It should be noted that the temperature of the piece itself and its critical points are indicated by the use of the Kritiscope and not the temperature existing in the furnace, as is usually recorded by a pyrometer. The device does not require calibration and is not affected by vibration or rough handling. The Kritiscope is self contained and has no electrical leads or connections. It can be read quickly and directly to ascertain the condition of the steel and the proper time for quenching it.

Engelhard Automatic Temperature Regulator for Gas Furnace

On page 1015, Vol. 52, of *American Machinist* there appeared a description of an automatic temperature regulator made by Charles Engelhard, Inc., 30 Church St., New York, N. Y. The device has recently been redesigned, so that it appears as shown in the accompanying illustration.

The principal changes lie in the addition of a generator to provide the low-voltage current that was formerly supplied from an outside source such as a storage battery. The generator is run by a motor operating on current from a lighting circuit. The position and arrangement of the solenoids have also been changed. A terminal board has been added at the end of the frame, which also is of changed design.

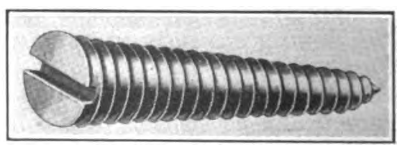


ENGELHARD AUTOMATIC TEMPERATURE REGULATOR

The device is ordinarily connected by means of chain to the valve on the gas pipe feeding the furnace. It is connected electrically to a pyrometer, so that the furnace temperature can be ascertained and held within a certain range. The machine itself has three main parts, the motive power, the escapement mechanism and the timer. The motive power consists of a $\frac{1}{12}$-hp. motor operating on either a.c. or d.c., a worm gear reduction having an 80 to 1 ratio, and a 25-watt, 6-volt, d.c. generator to furnish the power for the solenoids.

Plumb Take-Up Wedge for Hammer Handle

A device that provides for retightening the handle in the head of a hammer, hatchet or similar tool of the impact type has recently been applied to the tools made by Fayette R. Plumb, Inc., Philadelphia, Pa. This device, which is designated as a take-up wedge and is shown in the illustration herewith, consists of a tapered screw having uniform pitch throughout its length. A slot in the butt end of the screw enables turning by means of a screwdriver.



PLUMB TAKE-UP WEDGE FOR HAMMER HANDLES

Hickory is ordinarily employed for hammer handles

because of its toughness and springiness, although it shrinks with age and becomes loose in the head. The advantage of the take-up wedge is that not only can a handle be made tight when it is new, but it can always be retightened, so as to keep it tight in service.

To fit the screw to a tool, a hole is drilled in the end of the handle somewhat deeper than the length of the screw. It is then reamed to receive the screw, which is driven in until the butt end is flush with the handle. If the head becomes loose in the handle, a slight turn of the screw again spreads the wood uniformly so that it grips in its socket and removes the looseness. The screw thread prevents the wedge from flying out under shock.

Simplified Cost Accounting

By Robert Brainerd

The value of cost records has never been appreciated as keenly as in these days when a difference of a few cents on the cost sheet is often the difference between industrial life and death. Many and diverse are the systems in use, but for the small shop, the writer has failed to see a method of cost-keeping that fills the bill any better than that in use by the Saginaw Stamping and Tool Co., Saginaw, Michigan.

When an order is received for a job, a shop order is made out in duplicate, the original of which is sent to the shop superintendent with the blueprint for the job. The shop order number is marked on the corner or back of the print, which is then passed on to the foreman, and ultimately, to the workman.

At the same time that this is done, the shop order is entered at the top of the cost sheet, as are the name of the firm from which the order was received, its order number and the date the order was received. The illustration shows the cost sheet in reduced size; full size is 8½x11 inches.

Each of the workmen who performs any labor on this job copies the shop order number on his clock card, and each day the amount of time spent on the job is recorded on the cost sheet. When the job is done, the total labor cost is entered in the last column opposite "total labor." Any material used on the job is entered on the shop order in the superintendent's charge, and on the completion of the job this is turned in to the office and the items transferred to the cost sheet in the proper locations. Ten per cent is added to the total cost of the materials to cover the cost of handling, freight, express, etc., this having been found to be approximately correct on the average. Adding the correct percentage for overhead expense is a simple matter.

The rate per hour to be charged for the job is entered in the lower left corner of the sheet, if the job is taken on an hourly basis; or the contract price is entered if a fixed sum is to be charged for the entire job. The rate per hour varies of course, with the nature of the job.

The results obtained are accurate enough for all practical purposes, and the low cost of obtaining the desired information recommends it for the small or medium sized shop.

There is another value to the cost sheets. Frequently it is necessary to estimate on similar work and records of past performance are invaluable. The shop that can estimate accurately has it all over the one that can't.

Saginaw Stamping and Tool Company
SAGINAW, S. S., MICH.
COST SHEET S. O. No.

NAME ______ THEIR ORDER NO. ______ DATE ______

DATE	CLOCK NO.	HOURS	RATE	WAGES	DATE	CLOCK NO.	HOURS	RATE	WAGES	MATERIAL	TOTAL
										CAST IRON	
										MACHINE STEEL	
										COLD ROLLED STEEL	
										CARBON TOOL STEEL	
										HIGH SPEED STEEL	
										DRILL ROD, SCREWS, PINS, SPRINGS	
										PATTERNS	
										FREIGHT AND EXPRESS CHARGES	
										MISCELLANEOUS	
										TOTAL COST OF MATERIAL	
										10% FOR HANDLING MATERIAL	
										TOTAL LABOR	
										OVERHEAD	
TOTAL										TOTAL COST OF TOOL, $	

______ HOURS AT $ ______ PER HOUR, $ ______

CONTRACT PRICE, $ ______

SMALL SHOP COST SHEET

News Section

American Gear Manufacturers' Association

Semi-Annual Meeting at Chicago Well Attended—Many Valuable Committee Reports on Standardized Gear Practice—Apprenticeship and Costs Live Subjects for Discussion

The ninth semi-annual meeting of the American Gear Manufacturers' Association took place at the Drake, Chicago, Oct. 9, 10 and 11. The meeting was characterized by the usual informality and close attention to business and much work was accomplished.

Most of the many standing committees brought in reports of progress that indicated the immense amount of hard work going on behind the scenes. Definite recommendations were presented by F. E. McMullen, of the Gleason Works as chairman of the Bevel and Spiral-Bevel Committee and were acted upon. The association approved by unanimous vote the motion of Mr. McMullen to adopt as suggested practice for future use, the Gleason system of bevel gears with three different pressure angles as published in *American Machinist*, page 849, Volume 56. The committee's recommendations as to nomenclature and thrust values for spiral bevel gears were adopted as recommended practice. This report will be published in an early issue.

A paper by Prof. D. L. Rich, of the University of Michigan on Standardization of Gear Sounds evoked considerable interest and led to a good deal of discussion. Prof. Rich stated that there were three ways of combating noise of any kind: By absorption of the noise in sound deadening material as in the soft hangings of auditoriums; by insulating the source of noise or the compartment in which it is produced; and by elimination of the noise at the source, as by improving the quality of the gears in a transmission. He discussed the various methods and instruments for measuring sounds and noises and gave as his conclusion that it would be possible to devise means of determining whether a given gear combination was noisier than a definite standard, but not how much.

Other papers were "The Evolution of the Gear," by George L. Markland, Jr., president of the Philadelphia Gear Works; "Why Buy a Pig in a Poke," by L. G. Hewins, Sales Manager The Van Dorn & Dutton Company, and "Engineering Research," by Prof. E. A. White of Michigan.

On Monday evening P. C. Molter, superintendent of the Department of Industrial Education of the National Metal Trades Association, addressed the members on Apprenticeship. The diminishing supply of skilled machinists in the industry was dwelt on by several members in the discussion that followed and the apprenticeship system was felt to be the only means of training new men to fill the gap.

At the business meeting three new member companies were elected: American Gear Company of Chicago, Dalton & Balch of Chicago, and the Manns Manufacturing Co. of San Francisco. Several additional representatives of member companies were also elected.

At the banquet the speakers were Gen. John V. Clinnin, who spoke on "The World War and Its Effect on American Business," and Judge Marcus Kavanaugh, who chose as his subject, "Business Men and Law Enforcement."

The meeting afforded the members present a good chance to get acquainted with the new secretary of the association, Mr. T. W. Owen, whose office is Room 107, 2443 Prospect Avenue, Cleveland, O. It was announced that the seventh annual convention of the association would be held in Cleveland on the last Thursday, Friday and Saturday in April, 1923.

American Engineering Standards Committee Handling 106 Projects

The growing interest in standardization on the part of almost every American industry is emphasized by the quarterly report of the activities of the American Engineering Standards Committee issued from the headquarters of the committee at 29 West 39th Street, New York City.

Of the projects which have official status before the A. E. S. C., twenty are concerned with mechanical engineering; 17 are civil engineering projects; 15 are electrical; 3 are automotive; 10 are concerned with transportation; 10 with ferrous metals; 11 with chemical; 5 with non-ferrous metals; 4 with mining; 2 with textiles; 1 with shipbuilding, and 8 projects are of general interest.

Twenty-four standards or safety codes have been approved and 36 are up for approval. The remaining 46 projects represent codes and standards which are either in the process of formulation, or which are now being considered by committees of representatives, designated by the various bodies, industrial, technical and governmental, interested in each particular subject. In this way, more than 200 such bodies are officially participating in the work of the A. E. S. C. through their accredited representatives.

A regular interchange of information as to the status of work under way is maintained by the American Engineering Standards Committee with the national standardizing bodies of Austria, Belgium, Canada, Czecho-Slovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden and Switzerland. This information is issued in the form of quarterly reports and includes a statement of the status of each project on which work is actively under way.

George Richards—An Appeal

We regret to learn that Mr. George Richards—thirty years or so ago, of the well-known Manchester firm—is new disabled owing to paralysis and quite incapable of any further work. He suffered serious financial loss during the war and, though direct appeals have been made to his relatives, is now dependent on the kindness of his friends for support. Endeavors are being made by some of these to raise a fund to assist him and, at his desire, to provide for the maintenance and education of his youngest child, a boy of 13, until he is able to support himself. Subscriptions will be gratefully received by Mr. A. J. Munro, 103 Cornwall Rd., South Tottenham, N. 15, or by Mr. Leslie N. Burt, 7 Outer Temple, W. C. 2. London, England.

This is, indeed, a worthy cause and one which merits the attention of the machine tool industry. Too often does it happen that a life spent with unexampled toil in the advancement of an industry and its products is found in the evening of its career dependent upon our generosity and gratitude. We feel sure that those of our readers who are acquainted with Mr. Richards' work in the past and know of his genius in the design of machine tools will not hesitate to help him in the adversity that has overtaken him.

Machine Tool Exports Show Little Change

Metal working machinery to the value of $1,032,483 was exported during August. This is slightly under the July exports, valued at $1,074,371. As compared with August 1921, the exports show an increase of $100,920. Exports for July, 1921, on the other hand, exceeded those of August of the current year by $702,012. The Department of Commerce furnishes the following details:

EXPORTS METAL-WORKING MACHINERY

	July, 1922	August, 1922
Lathes	$61,443	$52,963
Boring and drilling machines	28,059	31,370
Planers, sharpers and slotters	33,881	11,980
Bending and power presses	7,351	16,061
Gear cutters	25,791	15,290
Milling machines	27,597	27,631
Sawing machines	1,013	3,145
Thread cutting and screw machines	16,756	13,530
Punching and shearing machines	9,581	6,735
Power hammers	8,973	10,534
Rolling machines	129,881	734
Wire-drawing machines	2,475	1,665
Polishing and burnishing machines	330	396
Sharpening and grinding machines	54,483	79,356
Chucks, centering, lathe, drill and other	17,519	23,566
Reamers, cutters, drills and other parts for machine tools	89,485	100,295
Pneumatic portable tools	41,980	44,772
Foundry and molding machinery	28,467	70,228
Other metal-working machinery and parts of	489,306	522,232
Total metal-working machinery	$1,074,371	$1,032,483
IMPORTS		
Machine tools	$14,762	$18,926

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

TO A FRIEND who congratulated him upon his serenity in a panic, the late Pierpont Morgan is said to have remarked, "It always stops raining." His philosophic observation is recalled now because upon the expectation and declaration of stock dividends the market value of the various Standard Oil securities has increased by over a billion dollars in the past year.

Nearly one-half of this increase is due to the advance recorded since Aug. 18 last, when the market value of the various Standard Oil issues was $1,728,000,000 as compared with $2,223,000,000 on October 10. But this advance has not added a penny to the earning power or assets of the properties affected, and unless their market value was absurdly low two months ago it is now too high.

But whatever the facts in respect of intrinsic values may be, it behooves us to remember that it cannot rain stock dividends or anything else all the time and it is quite possible that the wild and thoughtless buying of oil stocks in general and Standard Oil stocks in particular which this distribution of new shares has induced may mark the culmination of the bull movement in securities.

There are other reasons for thinking that this may be the case. The Standard Oil shares are now more widely distributed than ever before. In one way or another the money market will be called upon to supply a large share of the increased capital required to carry them at their enhanced valuation. Commercial loans are meantime increasing and Secretary Mellon's action in bringing out half a billion 30 year government bonds at 4¼ per cent has established that rate as the irreducible minimum at least for the present. We may therefore expect a gradual hardening of the money market, accentuated in all probability by the freight blockade which will retard the conversion of the goods in transit into cash.

These are the considerations which lead me to advise great caution in making commitments that assume a further advance in the stock market.

From this generalization the railway shares may perhaps be excepted, for it is quite possible that the phenomenal earnings indicated by the present heavy traffic may offset the influence of higher interest rates and the speculative liquidation of the oil and industrial stocks that seems to impend.

Neither is it to be expected that the commodity markets will be susceptible to the monetary and speculative influences to which the stock market is so sensitive. There has been no great speculation in merchandise. Stocks are very light. Wages are high. There is no unemployment anywhere. In fact, a scarcity of labor is reported from some regions and there is every indication that a nation that can spend half a million dollars on a baseball game will not be deterred from making normal purchases by the slight advance in prices thus far established or in prospect.

This prognosis is confirmed by the trade reports of the week. In both the primary and retail markets a good business at gradually rising prices seems to be passing. Wheat is firmer and slightly higher. So are corn and cotton. Cotton goods are conspicuously active and firmer. There are some who are coming to feel that this year's cotton crop has been slightly underestimated, but with the president of the Manchester Exchange pleading that America should bestir itself to raise 16,000,000 bales of cotton no one now fears that a yield of even 11½ million bales this year would depress prices.

> **Those who at the present time are attributing the advance in commodity prices to inflation are implying that our gold has less purchasing power than formerly. If this be true then the inflation is a permanent rather than a temporary condition, and likely to continue as long as we insist that debts be paid in gold rather than goods for our exportable surplus.**

Wool and woolen goods, silk and its products, furs, hemp, jute, burlaps, iron, steel, copper and most other metals, coffee, sugar and rubber are all in good demand at prices which are in nearly every case of the seller's making. The advance in rubber, which is now selling at 19½ cents for January delivery, is due to the gradual crystallization of the plans for restricting the production that have been so long under consideration, and the improvement in sugar to an appreciation of the fact that the surplus stock will have nearly disappeared before the new crop becomes available.

Eggs, of which there is, curiously, an overproduction, and coal are the only articles that have declined during the week and unless the official reports are misleading there is every reason to expect that there will be enough coal to go around during the winter if no one is allowed to "hog" more than a month's consumption in advance.

For the upward tendency in prices so generally reported there must of course be some general reason. Charles J. Webb, president of the Philadelphia Textile Association, attributes it to a "second inflation" against which he warned his hearers in an address last week.

But inflation is a much used word that is difficult of definition. When it first found a place in the economists' vocabulary it meant a rise in prices due to a dilution of the currency and a consequent depreciation of its value as expressed in commodities. But unless the gold that the banks are forcing into circulation has depreciated in value or purchasing power there has been no dilution or depreciation of our currency.

Therefore those who attribute the advance in commodity prices to inflation are by implication compelled to admit that gold has less purchasing power than formerly. This is, I think, the fact, and if it is the fact then the inflation of which so many are apprehensive is a permanent rather than a temporary condition that is likely to persist in this country as long as we insist upon being paid in gold rather than goods for our exportable surplus.

That it should be exclusively reflected in the commodity markets and without effect upon securities is entirely logical, for most securities, and especially bonds, are nothing more than certificates which attest the investment of so many dollars whose number and value as expressed in the gold in which they are payable is not affected by a change in the purchasing power of the gold as expressed in commodities.

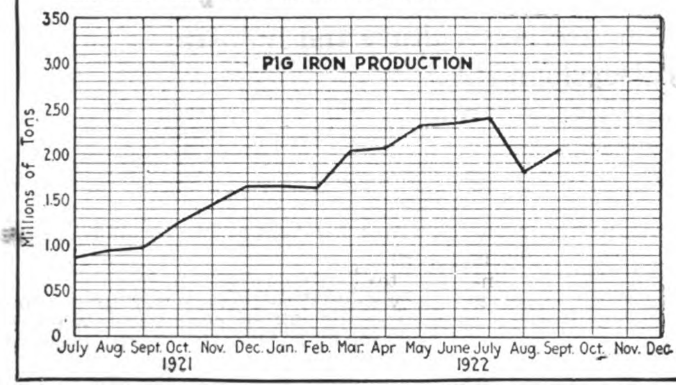
If this be correct, then it is highly probable that business will continue to feel the artificial stimulus of "gold inflation" and advancing prices until the latter is checked by an expansion of credit that will exhaust bank reserves and compel contraction. The weekly statement of the Federal Reserve banks indicates that this expansion has already commenced in that rediscounts have increased by 91 millions, but we are still some distance from the inevitable reversal for the reserve ratio of 75.7 per cent is only 1.7 below last week's figure and is quite high enough to assure comparatively easy money for some time to come.

Any serious curtailment of credit is not therefore by any means imminent, and it seems likely that the present upward movement in commodity prices will continue during the winter.

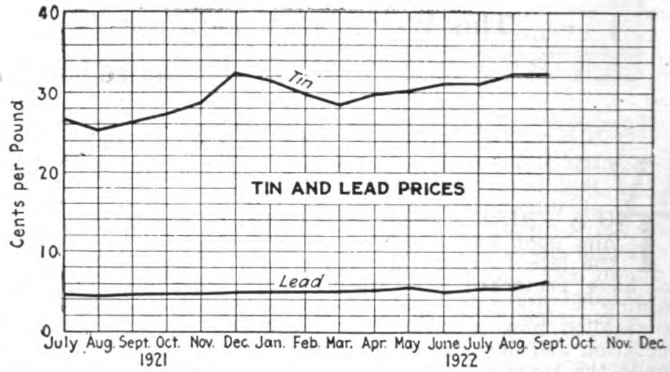
The news from abroad is reassuring and the barometer of sterling exchange, which is higher, indicates clearing weather in Europe politically as well as financially.

The German mark, which sold as low as 3¾ cents a hundred last Tuesday, is so low that it is hardly worth talking about. My private advices are that dollars are generally displacing it as a medium of exchange in Germany and the time is probably approaching when the mark will be officially, as it is now practically, demonetized.

Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Institute.



Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



PIG iron production during September totaled 2,033,720 tons as against 1,816,170 tons in August, an increase of 217,550 tons which was not unexpected in view of the settlement of the labor troubles in the coal and railway fields. While September production is about 370,000 tons below the high point reached in July, it compares favorably with the average monthly production for the 9 months of the current year amounting to 2,033,993. An increase in the number of furnaces placed in operation toward the end of September is expected to result in a large October output.

Tin and lead prices were strong during September, the average price of the former showing but a fractional decline from 32.134 cents in August to 32.075 in September. Lead moved up to 6.110 cents as against 5.824 cents in the previous month. While there has been but a narrow demand, the low status of stocks on hand has served to keep the price firm. Present indications point to higher prices in the near future.

Automobile share markets were strong during September, the average price for ten representative issues advancing to $45.65 per share as compared with $43.40 in the month previous. Except in a few cases, where new financing is under way, the car manufacturing companies show healthy financial statements. Production of cars and trucks continues to record high totals and the demand both for domestic and export consumption shows a steady increase.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

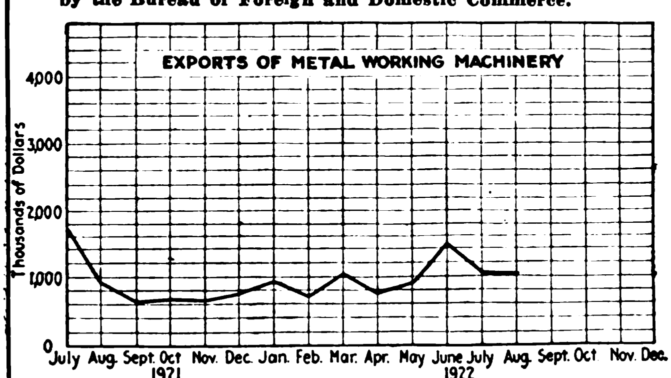
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0292	$0.0285	$0.0273
Cold finished shafting......	per lb........	0.0378	0.0365	0.0384
Brass rods.....	per lb........	0.165	0.1700	0.135
Solder (½ and ½)	per lb........	0.22	0.225	0.20
Cotton waste..	per lb........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	3.83	4.00	5.00
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal.......	0.575	0.575	....
Machine oil....	per gal.......	0.36	0.36	....
Belting, leather, medium......	off list........	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

Metal working machinery exports held up well in August and were valued at $1,032,483. This total is exceeded in the current year only by the exports for March, valued at $1,057,106 and July, valued at $1,074,371. As compared with the month of August, 1921, however, there is an increase shown of $100,920. Imports of machine tools continue in small volume. Tools to the value of $18,926 were brought in during August as against $14,762 in July and $16,101 in the same month a year ago. With an improvement in the European situation, and with an adjustment of war debts upon a reasonable basis, an era of industrial activity should follow, resulting in a wide expansion of machine tool exports.

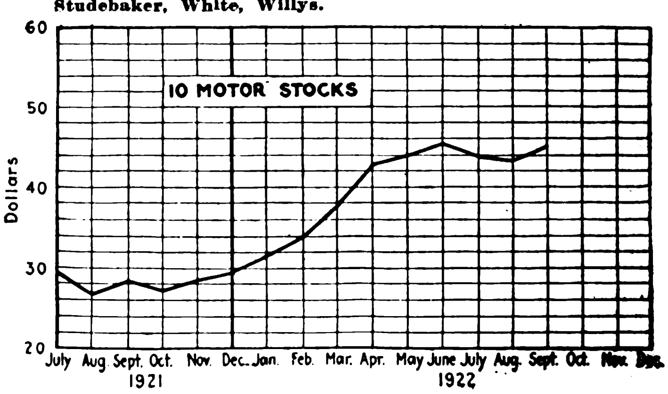
Steel ingot production in September according to figures compiled by the American Iron and Steel Institute, totaled 2,373,779 tons, an increase of 159,197 tons over August. This compares with the current year's high point reached in May with a production of 2,711,141 tons.

Railway earnings on American roads experienced a sharp decline in revenue during August due to the shopmen's strike as compared with July and with August, 1921. The total net operating income for 197 roads of Class 1, for August amounted to $52,579,799, or at the rate of 2.65 per cent as against July income of $69,239,037, or 4.04 per cent, on the assumed valuation of $19,165,800,000 for American railway properties, in excess of $95 millions monthly required for 6 per cent return.

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Average price of ten automotive stocks: Chandler, General Motors, Hupp, Int. Motors, Pierce, Stewart, Stromberg, Studebaker, White, Willys.



British Textile Machinery Industry

Extraordinary Prosperity Since the War—Former Markets Being Recovered—Big Increase Shown in Exports

By A LONDON CORRESPONDENT

WHILE every other industry in Britain has been in the depths of depression during the last two years, it is a curious fact that the textile machinery trade has enjoyed a unique experience. At a time when every other English trade was suffering acute unemployment, due to the blighting influence of the very general slump, there has been no lack of work for the textile machinist in Lancashire. Orders have poured in from all parts of the world. The devastated factory towns of France and Belgium have been excellent customers, while from the Far East and many parts of the Empire heavy demands have come for the textile machinery specially made in the north of England.

The leading firms have indeed had the time of their lives, although no one can honestly begrudge their good fortune. The profits of one well-known Lancashire firm were enough, in 1921, to pay a dividend on the ordinary shares after providing for all liabilities, fixed charges, etc., and allowing a large sum to be carried forward of not less than 37 per cent, although the management wisely decided to put part of this to additional reserve against future lean years.

EXPORTS APPROACH PRE-WAR POINT

This is just a sample of what has been going on in the English textile machinery trade during the last 18 months or so. And there is every indication of this activity continuing as large orders are coming to hand from the Far East, especially India, which is one of the very best customers for our textile machinery.

To give an idea of the magnitude of the business done, I may add that in 1913 the value of shipments of textile machinery was just over £8,000,000, whereas in 1921 it was over £25,000,000. The tonnage last year, however, was 156,995 as against 176,074 in 1913, figures which are eloquent as to prices. Ten years ago the price paid per ton for this class of machinery was £47. In 1921 the average price was £160. This year the rates have been easier, the prices paid by foreign customers having gradually fallen to £148 per ton, but high rates will rule for many a long day as the demand shows no considerable diminution.

When the war ended it was found that France and Belgium were largely destitute of textile machinery, this being the case particularly in northern France, the object of the Germans having been to destroy the French textile industry which they thought they could do by smashing up all the productive machines. If they could have destroyed all the Lancashire textile machinery workshops and all the patterns contained therein, they would have been much nearer their object. Today the French textile factories which were destroyed have been largely rebuilt with new British machinery.

When the war came to a close an agreement was entered into between the British, French, and Belgium Governments that the two latter nations should have a prior claim upon deliveries from British textile machinery factories. This understanding has been carried out with the above-mentioned result. It may be added that a leading British association has put into operation in France a new mill of over 50,000 spindles.

While British textile machinists have been very busy repairing the ravages of war on the Continent, that alone would not have been sufficient to have created the boom had not large orders been received from the great Far Eastern markets, such as India, China, Japan, etc. It is officially stated that two English firms alone have booked orders aggregating £13,000,000.

> With the engineering industries of England in the past two years suffering, perhaps, the most severe depression ever experienced in their history, the activity of the producers of textile machinery in the British Isles stands out in bold relief. From all quarters of the globe have come orders for machinery to produce fabric for the w o r l d's inadequately clothed population. A careful survey seems to indicate that it is only a beginning.

Shipments of textile machinery to India of late years have been on a very extensive scale. In 1913 English exports were 50,000 tons, valued at £2,000,000, against over 60,000 tons in 1921, valued at nearly £9,000,000. It is currently reported on very good authority that British makers have extensive contracts on their books for Indian firms, and it is thought likely that shipments will continue on a large scale for the next three years at least and perhaps longer. The mills in India have increased in number, from 56 in 1880 to 253 today. In the same period there has been an increase in the number of spindles from 1,462,000 to 6,763,000, looms also increasing from 13,500 to 120,000.

GREAT ACTIVITY IN THE ORIENT

There is every indication that China also has entered upon a period of activity in cotton manufacturing and this is one of the most promising markets for textile machinery. In 1913 England sent only 3,382 tons of such machinery to China, valued at £138,058. Last year the shipments totalled 16,489 tons, and were valued at over £2,000,000. Today China has 63 cotton mills containing 1,650,000 spindles and 7,650 looms, with many others planned or contemplated. It is a source of satisfaction to see that a more enterprising and enlightened policy is now being adopted by commercial organizations in the extension of cotton spinning in the Orient.

Japan is another market where British textile machinery has done well lately and which offers splendid opportunities for the future. In 1913 English exports to that country of such machinery totaled 19,688 tons, valued at £802,643. In 1921 they totaled 22,531 tons, valued at over £3,000,000 and this in spite of the depressed condition of Japanese trade. Of course, during the period of the war Japanese manufacturers had the time of their lives and made huge fortunes, but matters are very different today. In consequence of the small amount of shipping which was available to send supplies of goods from England to India, Japanese merchants naturally took advantage of their opportunities and secured a substantial amount of business from India. Japan now possesses 119 mills containing 3,814,000 spindles and 50,600 looms. The latest reports from Japan indicate great activity in building new textile mills all requiring equipment.

JAPANESE CAPITAL IN CHINA

But Japanese capitalists are not alone content with their home market. At the present time they are largely interested in erecting cotton mills in China and it has recently been reported that British firms have received new orders for spinning machinery to be supplied to China under the auspices of Japanese capitalists. One order, it is stated, is for over one million spindles. According to the latest official figures by the British Board of Trade, Japan and China have really been the backbone of the recent boom of English exports of textile machinery to those countries.

TABLE NO. 1, SHOWING TONNAGE AND VALUE OF BRITISH TEXTILE MACHINERY FROM THE UNITED KINGDOM FROM 1913 UP TO AND INCLUDING THE FIRST SEVEN MONTHS OF 1922

Year	Tons	£
1913	178,074	8,281,848
1914	116,383	5,766,502
1915	59,447	3,332,365
1916	59,268	4,107,707
1917	49,271	4,203,671
1918	36,531	3,943,001
1919	65,938	8,430,725
1920	63,314	9,158,773
1921	157,005	25,148,832
1922 (7 months)	77,275	11,488,339

Lancashire textile manufacturers are, of course, quite aware of this enormous export of machinery which is for use in foreign factories and destined to produce textile goods in competition with their own. On the face of it, it looks as if Lancashire would gradually lose its export cotton trade and that it is in a sense "cutting its own throat" by sending large quantities of textile machinery to India, China and Japan, thus enabling manufacturers in those countries to produce large quantities of cloth. It is generally thought, however, that it will be a long time before the new mills can have very serious effect

TABLE NO. 2. SHOWING THE BRITISH EXPORTS OF TEXTILE MACHINERY, THE COUNTRY TO WHICH SHIPPED, AND THE TONNAGE AND VALUE IN EACH CASE

Exported to:	1913 Tons	1913 £	1920 Tons	1920 £	1921 Tons	1921 £
Russia	15,308	995,296	188	40,973	3	2,235
Germany	13,917	783,896	43	15,771	341	121,399
Netherlands	12,171	412,515	1,374	182,493	2,470	374,581
France	12,630	735,901	17,001	2,836,054	24,383	4,332,017
Other European countries	22,695	1,162,142	8,948	1,404,067	12,720	2,788,299
China	3,382	138,058	2,616	306,022	16,499	2,097,799
Japan	19,688	802,643	8,051	860,221	22,531	3,086,298
U.S.A.	3,939	250,784	1,745	337,641	6,397	1,476,998
South America	12,879	531,432	2,239	363,546	5,404	868,092
British E. India	50,437	2,001,157	17,945	2,303,275	60,276	8,873,424
Australasia	1,417	64,008	632	109,698	1,691	284,531
Other countries	9,611	404,016	2,532	399,072	4,290	843,159
Totals	178,074	8,281,848	63,314	9,158,733	157,005	25,148,832

upon the export of textiles from Britain. It should also be remembered that the machinery recently installed is really four times dearer than pre-war values. This increased cost of machinery will be a serious handicap to those mills when they come to compete with mills not so burdened with expensive plant. It should also be remembered that the standard of living throughout the world steadily improves and as the huge populations of India, China and Japan become more civilized and rise nearer to Western ideals of life, they will tend to clothe themselves in fabrics that are of better quality than they have done heretofore.

In table No. 1 there is shown the development of this branch of British engineering industry, the tonnage and value of British textile machinery exports being given for the years 1913 to 1922.

In table No. 2 a segregation is shown of the principal markets to which British textile machinery has been exported in the years 1913, 1920, 1921.

It is interesting to note that the value of exports of textile machinery from the United States has risen from $1,611,279 in the year ended June, 1914, to $10,507,822 in 1921. The exports to China during this time have risen from $51,478 to $2,783,093 in 1920. To Japan they have increased from $10,608 to $3,764,247. These two countries have also taken the bulk of American exported textile machinery. British East India is another country well worth attention. In 1914 her importers of this class of machinery only purchased $252 worth of machinery of American manufacture which in 1918 bounded up to over $300,000 but fell in 1920 to $44,707. In 1919, the United States were sending England over 3 millions' worth of this machinery, but in 1920, the last year for which figures are available, the trade had fallen to $96,746.

The Far East is undoubtedly the great market for the future for both British and American textile machinery.

An encouraging demand for many years seems to be assured and there is not likely to be over-production or extreme competition so far as Britain is concerned. British makers will be very busy filling orders for the home mills, for replacement of old and worn-out machinery and for extensions so that their attention will not necessarily be given entirely to the foreign markets.

The textile machinery builders of this country have, indeed, been fortunate. They have been working at high pressure for the last two years, while the other branches of the industry have been in the depths of the depression, many principal firms only receiving last year 10 per cent of the orders they executed in 1920 and 1919.

The S. A. E. Production Meeting

The Production Meeting of the Society of Automotive Engineers to be held in Detroit, Oct. 26 and 27 is to be a marked departure, which it is hoped and believed will be helpful in many ways. Originated by the engineers of the industry, the society has never before seen its way clear to give the production departmnets the benefit of close co-operation and closer social unity and this meeting is the first step to bring about this very desirable condition.

The personnel of the committees insures an interesting meeting. Members are: Meeting and Papers Committee, Karl L. Herrmann, Chairman, Thomas J. Litle, Jr., F. A. Whitten and C. Harold Wills; Factory Visits Committee, Kirke K. Hoagg, Chairman, E. F. Roberts, Thomas J. Litle, Jr., Howard A. Coffin and George E. Goddard.

There is every reason to believe that this will become an annual affair and one which cannot fail to be of lasting benefit to the industry. One notable feature is that every paper will be written by men who are in the production departments of the various plants, and who know from actual experience what is being accomplished. A glance at the list of papers and their authors will show the kind of information to be expected.

The meeting should attract production men and machine tool builders from all parts of the country and non-members will be made welcome in the good old S. A. E. way. There will be two morning sessions and at least four factories will be visited in the afternoons. An informal dinner, which is always an interesting feature of these conventions, makes another method of getting acquainted with the men in the industry. Every production man who can arrange to attend should do so. The papers are to be as follows:

Thursday, Oct. 26, 9:30 a.m.: The Group-Bonus and Its Application, by E. Karl Wennerlund; Cylinders From the Ore to Finished Part, by P. E. Haglund and I. B. Scofield; Tool Allotment and Costs, by F. A. Mance; New Methods of Processing Splined Shafts, by J. A. Ford.

Friday, Oct. 27, 9:30 a.m.: Problems Met in the Production of Air-Cooled Engines, by William Dunk; Some Experience from a Production Note-Book, by H. J. Crain and J. Brodie; Production Errors in Gears, by K. L. Herrmann; Selection of Machine Tools, by A. J. Baker; Machine-Tool Efficiency, by R. K. Mitchell.

There are many unusual problems met in the building of air-cooled engines and William Dunk of the Franklin organization will describe them in his paper. A. J. Baker of the Willys-Overland Co. will offer some pertinent suggestions on the selection and purchase of machine-tools. His paper will interest tool supervisors and factory superintendents.

Exporters Convention Opens Oct. 25

"Better Times Through Foreign Trade" is the slogan for the thirteenth annual convention of the American Manufacturers Export Association which will be held in New York City, at the Waldorf-Astoria hotel, Oct. 25 and 26. Responses so far received from invitations sent out to members point to a record attendance.

The opening session will be held on Wednesday morning, Oct. 25, at which delegates will be registered, reports of officers and committees will be received and new officers elected.

President Myron W. Robinson will address the afternoon session at which Dr. Julius Klein of the Department of Commerce will preside.

The speakers for the afternoon session of Oct. 25 have been selected from the various divisions of the Department of Commerce and the topics to be discussed are: Trade Situation in Western Europe, by Alan G. Goldsmith, chief of the Western European Division; Trade Situation in Eastern Europe, by Dr. E. Dana Durant, chief of the Eastern European Division; Trade Situation in the Far East, by Frank R. Eldridge, Jr., chief of the Far Eastern Division; Trade Situation in Latin America, by Ralph H. Ackerman, chief of Latin-American Division; Foreign Trade Disputes and Arbitration, by Archibald J. Wolfe, chief of Commercial Laws Division.

At the morning session of Thursday, Oct. 26, the topic will be "Shipping" which will be discussed by: Hon. Edward C. Plummer, commissioner, United States Shipping Board; and W. Averill Harriman, chairman of the board, United American Lines. Homer L. Ferguson, president and general manager, Newport News Shipbuilding and Dry Dock Co. will act as chairman.

In the afternoon the new tariff law will be discussed by: W. S. Culbertson, vice-chairman, Tariff Commission, Washington, D. C., and U. S. Senator Joseph S. Frelinghuysen, of New Jersey. W. W. Nichols of the Allis-Chalmers Manufacturing Co., Inc. will preside.

The annual banquet will be held in the evening of Oct. 27 with Alba B. Johnson of Baldwin Locomotive Works acting as toastmaster.

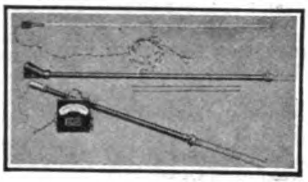
British Pig Iron Output Gains in August

According to a report recently issued by the National Federation of Iron and Steel Manufacturers of Great Britain the British production of pig iron in August amounted to 411,700 tons, or 12,600 tons more than in July. The average monthly output in 1913 was 855-000 tons. The August output included 120,200 tons of hematite, 137,400 tons of basic, 102,200 tons of foundry, and 22,900 tons of forge.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Pyrometer for Molten Metals, Portable
Hoskins Manufacturing Co., Lawton Ave. at Buchanan, Detroit, Mich.
"American Machinist," August 24, 1922

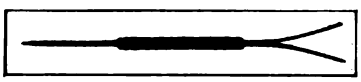


The pyrometer outfit gives instantaneous temperature measurements of molten metals and has renewable thermo-couple ends. It consists essentially of a standard Type-PA portable meter connected by 20 ft. of flexible copper cord to the thermo-couple. The two bare wires on the end of the couple are ordinarily furnished in 16-in. lengths. They are inserted into the molten metal, such as brass, bronze, aluminum, copper or babbitt, and the temperature can be read almost instantly on the meter. The upper temperature limit is about 2,200 deg. F. The scale of the meter is graduated directly in degrees F. from 32 to 2,500. Size, 6½ x 6 x 3 in. Weight, 5 pounds.

Metal, Non-Ferrous Alloy, "De Bats," No. 4
De Bats Sales, Inc., 60 South St., Boston, Mass.
"American Machinist," August 24, 1922

The metal is in the tungsten-chromium-cobalt class and possesses endurance and ability to withstand high speeds when cutting cast iron and the higher alloy steels. It contains no ferrous compounds and is non-magnetic. It is melted in electric furnaces and cast in molds of steel in the form of toolbits, inserts for built-up milling cutters, twist drills and reamers. The metal cannot be forged nor annealed, and can be worked only by the grinding process. It may be given rake and clearance angles approaching those of high-speed steels. Standard sizes of toolbits are furnished to be held in holders, while for more severe duty slabs or blocks are welded to carbon-steel backings.

Scriber, Self-Guiding, "Duwell"
J. A. Finley Co., 20 Braintree St., Allston, Mass.
"American Machinist," August 24, 1922

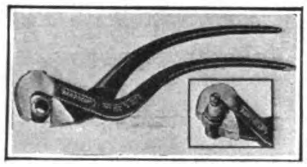


The self-guiding scriber is intended for the use of mechanics, particularly tool makers. It has a double point by means of which an outline at the bottom of a small, irregular-shaped hole may be laid out. One of the points is made sharp to do the scribing while the other one is slightly rounded and a trifle shorter. The points are pressed together and put in the hole. The tool is twirled around and the spring point causes the scribing point to follow the outline of the hole. For larger holes the single point at the opposite end of the tool is used in the regular manner.

Centering Device, "Duwell"
J. A. Finley Co., 20 Braintree St., Allston, Mass.
"American Machinist," August 24, 1922

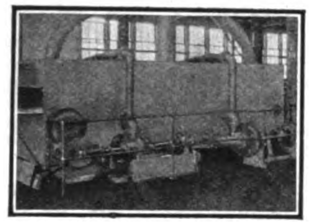
The tool is for center-marking round stock rapidly and accurately. The hub has a reamed hole through its axis to which is fitted a ground center punch. Extending radially from the hub are three steel posts, equi-distantly spaced around the periphery, and upon each post is a sliding jaw. A bushing or spider, having an equal number of radial bosses fits over the hub so that it may be rotated without endwise movement. Connecting rods join the radial bosses to the jaws upon the hub, so that when the bushing is rotated relative to the hub the toggle action of the rods causes the jaws to slide simultaneously inward or outward according to the direction of the rotation. After centering, a light blow of the hammer on the outer end of the punch marks the center.

Wrench, "Kant-slip"
Allan-Diffenbaugh Wrench and Tool Co., Baraboo, Wis.
"American Machinist," August 24, 1922



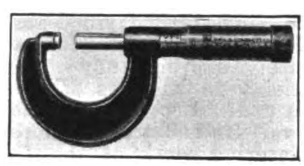
The wrench will grip work of any shape and readily adjust itself as to size. The sliding fulcrum is closed to the load and there are no screws, pins or springs to wear out or break. On top of the stationary jaw is a raised flat, forming a hammer head so that the wrench can be used as a hammer for light blows. The opposite end of the stationary member is formed into a screw-driver.

Washing Machine, Metal-Parts
Crescent Washing Machine Co., New Rochelle, N. Y.
"American Machinist," August 24, 1922



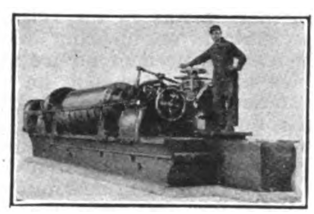
The machine is for washing metal parts that are handled in quantities of 50,000 to 100,000 or more per day, and is arranged for washing, rinsing and drying. It is fitted especially to clean work requiring a great force and volume of water. A 3-hp. motor drives the pump for the rinse water. Small objects are placed in racks made of wire mesh, and two racks 18 x 24 in. in size can be fed into the machine side by side. They are carried continuously through the machine on the conveyor, so that they pass under both the washing and rinsing sprays. Capacity, 24 in. high, 40 in. wide and 16 ft. long.

Micrometer, 1-Inch, No. 435
L. S. Starrett Co., Athol, Mass.
"American Machinist," August 24, 1922



The frame is drop-forged with a ribbed section that adds greatly to its rigidity. It is finished in black enamel. The diameter of the screw is 0.312 in. and that of the contact points 0.270 in. Decimal equivalents are marked on the thimble. The micrometer can be furnished either with or without a ratchet stop.

Grinding Machine, Roll, Heavy-Duty
Landis Tool Co., Waynesboro, Pa.
"American Machinist," August 31, 1922



The grinding machine is for finishing all types of hot and cold mill rolls. It is entirely self-contained and is driven by three separate motors, one driving the work, another driving the grinding wheel, and a small motor driving the water pump. All three are controlled by means of push buttons on the operator's platform, which is mounted on the grinding wheel carriage so that the operator has a clear view of the wheel and the work. The wheel can be moved rapidly toward and away from the work. An attachment is fitted for grinding the periphery of the roll either concave, convex or straight.

Clip, paste on 3 x 5-in. cards and file as desired

Death of Chas. S. Gingrich

In the death of Charles Sumner Gingrich the machine tool interests of the country have lost one of their most active and widely known members, Mr. Gingrich passed away on October 10, 1922, aged 48 years. For twenty-two years he had been in the sales engineering department of the Cincinnati Milling Machine Co., and during his latter career was in charge of this important division of the company's work.

Those who knew Mr. Gingrich appreciated his rather unusual and remarkable personality, for he was not only an acknowledged expert in his particular line, but he possessed a mind of distinctly scientific bent. His interest in his daily work did not exced his study of abstract scientific subjects of a diversified character. The general laws of nature as they are expressed in physics, astronomy, botany and chemistry, captured his vidid imagination and occupied the time he could spare from his business career. There was probably no field of material science in which he had not a very intelligent, well organized knowledge. Naturally his mind turned from abstract principles to direct application with ease and surety, and his study of the relation of science to business stimulated in him an unusual concern in educational matters. He had a deep interest in the engineering work of the University of Cincinnati, and in the young men of that institution. His interest was evidenced by an active co-operation with the students employed by his company and in fact with all embryo engineers with whom he came in contact.

Mr. Gingrich was a man who thought clearly, and who acted directly. He translated his theories and his human interests into deeds of practical worth, whether it was in his relations to his mechanical engineering field or to students in need of advice and counsel.

On his business side he was known best as one of the group of able men who, during the last twenty years, have brought the Cincinnati Milling Machine Co. to its present position in the field of mechanical engineering.

He had a host of good and loyal friends throughout the country and his loss will be felt keenly in his business circles as well as in the scientific groups which were his chief pleasure next to his home.

(The above commentary on the life of Mr. Gingrich was written by Herman Schneider, Dean of the College of Engineering, University of Cincinnati, his closest friend.)

A.B.P. Convention Emphasizes Need for Accurate Facts and Figures

The seventeenth annual convention of the Associated Business Papers, Inc., was held at Hotel Astor, New York, October 11, 12 and 13. Simultaneously with it, the editorial conference had a very interesting session. Chief among the papers was one by Henry B. Dennison, president of the Dennison Mfg. Co., who pointed out the necessity of facts and figures in modern business. He maintains a research department to secure and record facts such as costs of materials, details of sales, personnel and other phases of the business.

Older types of managers sometimes resent the use of charts and figures, contending that it tries to replace business judgment. Nothing could be more erroneous as judgment can be no better than the facts on which it is based —and many times much worse. The use of facts tends to prevent quick decisions or snap judgments which are frequently wrong. He recognizes the value of intuition, but even here, real facts and figures help out in many ways.

Facts as a Buying Guide

The growth of the demand for facts has been very noticeable in his own organization in which committees are used very extensively. When the executive group has the facts, better judgment can be expected. A particularly good example was the fluctuations in the price of turpentine. Taking the average price for a period of years the policy is to buy relatively little when the price is above the average and more when it is below. This is believed to be better than to attempt to always buy at the very lowest price.

Records of individual employees, their performance as a whole, not only quantity or quality, but faithfulness, resourcefulness, initiative and dependability are all important factors which can only be accurately and fairly known by suitable records. And now they are applying records and time study to sales. They find that waiting time varies from 13 to 21 per cent, that 15 per cent is spent in clerical work on reports, etc.

Perhaps the most interesting and vital chart from the viewpoint of the machine builder is the chart of facilities so as to know when to order new machine equipment. This must be based on the line of normal growth and cannot depend on immediate needs except in the case of equipment which can be bought out of stock in the open market. When special machines which will take from 6 to 18 months for delivery are needed, they must be ordered in sufficient time. Facts and figures are not an end in themselves, but merely an aid to sound business judgment. And the aim of all business should be service to mankind.

Theodore H. Price, the well known economist spoke on the problem of selling to foreign countries in spite of tariff and other handicaps. Theoretically this seems impossible, yet he believes that men will find a way to buy the things they really want. And as we raise and manufacture many things which the rest of the world desires, he feels that they will find some way to buy them. We must, however, take long time paper or promises of pay, perhaps in the form of securities.

Mr. Price does not share the pessimism regarding the countries of central Europe, but likens the conditions to those in the South after the Civil War. Then Europe loaned money on Southern property, the Scotch being particularly noticeable in loaning on Southern cotton plantations. England also helped materially in financing our early railroads, London being the trading center for U. S. railroad bonds. He believes that well selected European securities will come back into good paying properties and points to Czecho-Slovakia as an example of what can be done.

Mr. Price decries the stress which is being laid on business cycles, believing it bad psychology to implant the idea that a business depression must follow a period of good business. He believes that the peaks and hollows of these cycles can be largely wiped out by a proper study of business conditions. He has faith in the collective judgment of the people of a democracy as usually being wise and prevailing.

The third session received a message from the American Engineering Standards Committee. A recommendation that was made that we clarify our speech. The business sessions took up the problem of selling advertising.

Business Items

The Spotz Manufacturing Co., Inc., Stamford, Conn., has been incorporated under the laws of Connecticut to manufacture machinery, and mechanical devices, etc. The concern will have a capital stock of $100,000, and will commence business with $50,000. The incorporators include: C. A. Spotz, Greenwich, Conn.; Carleton Pratt, 58 West 72nd St., New York; H. M. Rice, 100 Broadway, New York; William H. Spect, 337 East 87th St., New York; F. F. Harrower, Norwalk, Conn.; G. H. Bergmark, 200 Washington Ave., Pleasantville, N. Y.; O. A. Helmer, 645 Lexington Ave., New York., and A. H. Emery, Jr., Glenbrook, Stamford, Conn.

The Ford Motor Co. American plants for August established a new high production record of 136,132 cars and trucks. This compares with 130,107 for the month previous and with 109,172 for August, 1921.

The Rock Island Railroad, it is reported, will place orders for 40 new locomotives in the near future. Of the total order, 30 locomotives will be of the Mikado type and the remaining 10 of the Mountain type.

The Corner-Lock Manufacturing Co., Natick, Mass., has been incorporated under the laws of Massachusetts, to engage in the manufacture of locks, devices, etc. The capital stock is $50,000, and the incorporators include: Frank W. Everett, president; William F. Poole, 269 Chapman St., Canton, Mass., treasurer, and Dwight W. Robinson, secretary.

The Osgood Bradley Car Co., Worcester, Mass., has recently received an order for 100 electric cars for the United Electric Railways Co., Providence, R. I. The cars will cost about $12,000 each. The company has enough business on hand to keep them busy

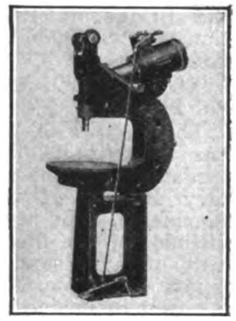
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Micrometer, Bench Measuring Machine, "Super"
Pratt & Whitney Co., Hartford, Conn.
"American Machinist," August 31, 1922

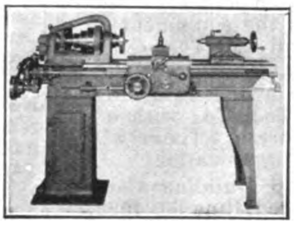
The "super-micrometer" has a capacity up to 8 in. in diameter, although its direct measuring capacity is only 0.500 in. The wheel is moved by a belt engaged by the knurled knob which has a smaller knob attached to it for rapid spindle adjustment. The final adjustment is made by turning the large knob very slowly. The rotation of the knob is continued until the belt slips. The standard inch blocks used in setting up are accurate within five millionths of an inch. The marks on the spindle are 0.050 in. apart. The 500 divisions on the dividing wheel are $\frac{1}{16}$ in. apart and each one denotes 0.0001 in. The channeled bar may be reversed for supporting flat work and the two tables can be laid on the bed to support larger work.

Press, Toggle and Lever, Pneumatic
Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.
"American Machinist," August 31, 1922



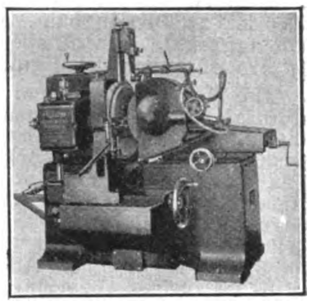
The general utility press is operated by means of compressed air or steam, with a power mechanism similar to that used on the riveters formerly made by the concern. It can be arranged with various forms of platens or work-supporting structures, so as to make it adaptable to straightening, bending, forcing, marking, embossing, coining, forging, briquetting and multiple riveting. The machine is made in tonnages of 15, 20, 30, 50, 70, 80, 100, 125, 150 and 200. It can be moved without moving any auxiliary equipment and requires only a small floor space. The die is mounted on an adjusting screw, controlled by hand or foot. The length of stroke can be adjusted.

Lathe, "Junior," 12-Inch
Hendey Machine Co., Torrington, Conn.
"American Machinist," August 31, 1922



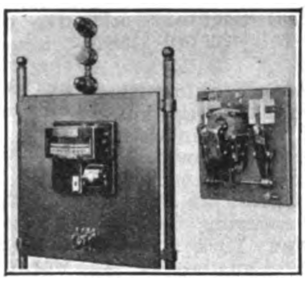
The tool is for light manufacturing purposes, in small shops and for vocational school service, where the full complement of attachments is not needed. It is belt-driven through a four-step cone, and is provided with change gears for screw cutting. Feed may be obtained either through the change gears or through a feed belt running over a three-step cone. Threads from 2 to 36 per in. may be cut. As in the regular model, the carriage traverse is stopped, started or reversed by the movement of a lever on the apron. With the two-speed countershaft furnished, 16 spindle speeds are available. The carriage is fitted with power crossfeed and compound rests.

Grinding Machine, Centerless
Reeves Pulley Co., Columbus, Ind.
"American Machinist," August 31, 1922



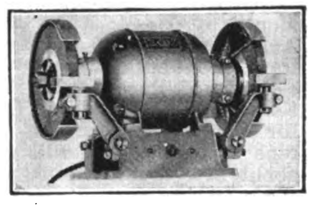
The special feature of the new model is the "drop-in" work rest which makes it possible to grind either shouldered, tapered or straight work. The rest supports the work in a true horizontal position between the two wheels, and a stop is provided which may be adjusted for different lengths of rolls. Another feature is the balancing ways and arbor for grinding wheels. Holes are drilled in the chuck just within the bore of the wheel and the balancing pins are furnished to be placed in the holes opposite the heavy spot.

Temperature Regulator, Automatic
Hoskins Manufacturing Co., Lawton Ave. at Buchanan, Detroit, Mich.
"American Machinist," August 31, 1922



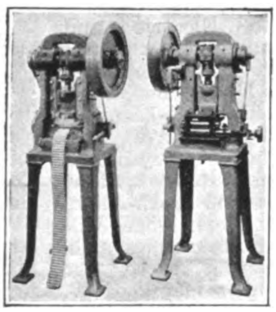
The apparatus is for controling the temperature of electric, oil or gas furnaces automatically, and operates every 30 sec. to test the temperature. The regulator is best adapted to the electric furnace. When the furnace is operating within 8 deg. F. of the desired temperature, a white signal light appears. If the temperature goes below this limit, a green light appears, while if it goes above a red one is lighted. The mechanism operates the control switch, so that the error is corrected before it has deviated more than 10 deg. from the desired temperature. The small motor operating the regulator can be supplied for either a.c. or d.c. of 110 to 220 volts.

Grinder, Electric, 8-Inch
Black & Decker Manufacturing Co., Towson Heights, Baltimore, Md.
"American Machinist," August 31, 1922



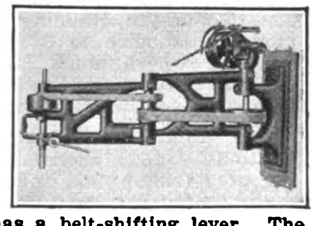
The small bench grinder carries wheels 8-in. in diameter and $\frac{3}{4}$ in. wide, and is driven by a $\frac{1}{3}$-hp. motor. The motor is not of the universal type, but is intended for operation on either d.c. or a.c. of 40 or 50 cycles and can be furnished for voltages of either 110 or 220. Large bearings carry the combined motor shaft and spindle. The no-load speed is 3,600 r.p.m. Two abrasive wheels, two wheel guards, two adjustable tool rests, a toggle switch in the base and 5 ft. of electric cable fitted with an attachment plug are furnished. The machine is arranged for mounting on a bench, but may be equipped with a pedestal. Weight, 75 pounds.

Press, Punch, Pillar
Geo. W. Dover, Inc., Providence, R. I.
"American Machinist," August 31, 1922



The press was developed primarily for work on radiator cells, although it is adapted to any sort of sheet-metal work within its capacity. It may be equipped with a roll feed. The machine is driven by a 3-in. belt on an 18-in. diameter flywheel having a solid web. Ram: stroke, $1\frac{1}{4}$ in.; vertical adjustment, 2 in.; maximum distance to bed, 5 in. Bed, $9\frac{1}{2}$ x 11 in. Floor space, 36 x 40 in. Weight with legs, 700 pounds.

Drill, Wall Bracket
Hammond Manufacturing Co., 6545 Carnegie Ave., Cleveland, Ohio
"American Machinist," August 31, 1922



The light swinging drill is for attachment to a wall or post and reaches any point within a radius of $3\frac{1}{2}$ ft. of its fastenings. It is adapted to work on parts for electrical instruments, switchboards, and stoves. The drill is belt-driven through tight and loose pulleys. The countershaft is geared to the upright shaft, from which two belts carry the drive to the spindle. The countershaft yoke can be set to any position to conform to the overhead drive, and has a belt-shifting lever. The two arms swing on stationary sleeves. The spindle has a No. 2 Morse taper hole and a traverse of $2\frac{1}{2}$ in. Two spindle speeds of 500 and 1,300 r.p.m. are provided. Capacity, $\frac{5}{8}$ in. in steel. Weight, 250 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

until next summer, and it is also expected to add to the present working force of 1,300 men.

The Connecticut Metal Treating Co., 207 Knowlton Street, Bridgeport, Conn., whose factory was completely destroyed by fire recently, has temporarily taken over the hardening plant of the Bridgeport Engineering Corporation, on Seymour Street, Stratford, Conn., and will continue operations there, until their new factory, now being planned, is completed.

The Delta File Works, Philadelphia, has reduced its list of files in accordance with the suggestion of Secretary Hoover of the Department of Commerce. The new list is supposed to include all the files needed by 95 per cent of file users, and the company points out to dealers that the other 5 per cent of business costs more than it is worth. This is in line with the tendency of manufacturers in some other lines and is a step in the right direction.

The Atlas Machinery and Supply Co., the Interstate Belting and Packing Co., and the Walstrum Armature Works, at Birmingham, Ala., suffered an aggregate loss of about $30,000 in a fire of unknown origin.

The McWane Cast Iron Pipe Co., according to an announcement recently by J. R. McWane, president of the company, has started work on the large plant to be constructed at Birmingham. It will require several months to construct the factory, the first unit being 340 by 108 feet, with a daily capacity of 8,000 feet of pipe. Additional units will be added covering, ultimately, about 30 acres.

The Mobile Pulley and Machine Works announces that an additional unit to its plant for the manufacture of steel and miscellaneous steel castings will be established at Mobile in the near future.

The Kilby Pipe Co., incorporated this month by E. M. Kilby and others, of Anniston, announces that another plant for the manufacture of pipe is to be established this year at Anniston, Ala. Foundry and shops will be established for the manufacture of castings and pipe fittings. This will give Anniston about fifteen large pipe plants.

The St. Petersburg Welding and Machine Co. has been organized and incorporated at St. Petersburg, Fla., with a capital of $20,000, and plans the establishment of a welding plant and machine shop. Officers are: T. D. Orr, St. Petersburg, president; D. J. Galaher, vice-president; A. M. Galaher, treasurer, and M. D. Shilling, secretary.

The Northwestern Expanded Metal Co., of Chicago, with a southern office at 716 Forsyth Building, Atlanta, has moved this office to 33 Poplar Street, Atlanta, where much larger quarters are provided, according to Arthur J. Swanson, southern manager.

The Southern Machinery Co., of Quitman, Ga., is increasing the capacity of its shop and foundry approximately fifty per cent by the construction of an additional unit, according to F. C. Underwood, president. The addition will be about as large as the present plant.

The Elliot Co., of Jeannette and Pittsburgh, Pa., manufacturer of power accessories, recently mentioned as planning the establishment of a southern sales office and warehouse in Atlanta, has opened offices in the Haas-Howell building in charge of H. A. Hoffman. The Atlanta office is the twelfth branch established by the Elliot Co.

The Rivett Lathe and Grinder Co., Boston, Mass., manufacturer of precision bench lathes, internal grinding machines and radial grinding machines announces a change of address for their Detroit sales office, which is operated in conjunction with that of Reed-Prentice Co., Becker Milling Machine Co., and Whitcomb Blaisdell Machine Tool Co., under the management of T. C. McDonald. The new quarters are located at 6526 Cass Ave., opposite General Motors Building. The sales force has been augmented by the addition of E. B. Barber, formerly superintendent of the factories of Lafayette Motor Co.

The Ampco Twist Drill and Tool Co., 18th and Howard Streets, Detroit, Michigan, has taken over the entire assets of the Detroit Reamer and Tool Co., formerly of West Congress Street, Detroit, Mich. The machinery and tools will be added to the equipment of the Ampco Twist Drill and Tool Co.

The West Sales Co., 1013 Ford Bldg., Detroit, Mich., will in the future be known as the West Tool Co., with offices at the same address. There will be no change in the organization.

The American Ship Building Company for the year ended June 30, 1922, reports total income of $1,585,182 before taxes and charges.

The Liquid Steel Welding Corporation, 401 West 23d St., Kansas City, Mo., has been organized by Anton Lucas, formerly with the Metal and Thermit Corporation, and will manufacture materials and appliances for welding, and welding compounds.

Lewis & Osborne, 713 Ohio Street, Wichita, Kan., have opened a new machine shop for general machine work and welding, and will install new equipment.

The Cutler Hammer Manufacturing Co., manufacturer of electric motor controllers, clutches, brakes, and other electrical equipment, New York City, announces the opening of a branch office in Buffalo, N. Y., 358 Ellicott Square, for the purpose of covering the territory of Western New York and the Province of Ontario, Canada. B. A. Hansen, formerly located in New York, has been placed in charge.

The Bridgeport Brass Co., Bridgeport, Conn., announces the opening of a Detroit office in the General Motors Building, Detroit, with Frank H. Longyear as district manager.

The Westinghouse Electric and Manufacturing Co. announces the following changes in its New York and Buffalo offices: C. W. Underwood, manager of the Buffalo office, has been appointed northern representative, with offices in Buffalo. The territory of the Buffalo office has been united with that of the New York office and A. E. Allen, manager of the New York office, will have charge of the Buffalo office also. Other changes, affecting these two offices, include the appointments of W. R. Marshall as branch manager of the Buffalo office; of E. W. Loomis as manager of the industrial division of the New York office; of W. A. Rossell as special power representative of the combined districts and of G. T. Dunklin as manager of the merchandising division of the New York office. The supply and power divisions of the New York office have been merged into the central station division under C. E. Stephens, manager, and the present railway division will in the future be known as the transportation division.

The Wilde Drop Forge and Tool Co., Kansas City, Mo., has filed incorporation papers with the secretary of State, Kansas, showing a capital stock of $50,000 and 1,000 shares of no par value. The company will manufacture, buy and sell tools, machinery of various kinds, act as manufacturer's agents and brokers. The shareholders are Mary Wilde, Goldie Wilde and Paul Froeschl.

The Porter-Cable Machine Co., Syracuse, N. Y., has purchased the Syracuse Sander Manufacturing Co., manufacturer of disc, oscillating spindle and belt sanders, and expects to move the business into the former's plant.

Personals

NEAL W. FOSTER, who has been acting manager of the National Acme Co., Windsor division, since the retirement of Mr. Gridley, has been appointed general manager to succeed Mr. Gridley and will have full charge of the Windsor plant.

DANIEL H. PARKER, who has been at the head of the purchasing department of the National Acme Co., Windsor division, has been appointed office manager of the Windsor plant.

TIMOTHY BYRNES has just been appointed general manager of the Lackawanna plant of the Bethlehem Steel Corporation.

ANTON LUCAS, for the past twenty-five years associated with the Goldschmidt Thermit Co., and its successor, the Metal and Thermit Corporation, has resigned and organized the Liquid Steel Welding Corporation, 401 West 23rd Street, Kansas City, Mo., of which company he will be general manager.

OLIVER L. HENN, formerly superintendent of the Windsor plant of the National Acme Co., has been appointed works manager.

BERT N. GREENWOOD, formerly with the Greenfield Tap and Die Corporation and with their predecessor in the manufacture of Greenfield grinders, the Greenfield Machine Co., has joined the sales force of Russell, Holbrook & Henderson, Inc., and will be stationed at Bridgeport, Conn.

KEITH J. EVANS, advertising manager of Jos. T. Ryerson & Son, Chicago, and Miss Harriet S. Guthrie were married in Riverside, Ill., on October 7.

J. F. GEARY, recently superintendent for the Niagara Radiator Co., North Tonawanda, N. Y., and previously in charge of various plants of the United States Radiator Corporation and American Radiator Co., is now district manager in western New York, Ontario and northwestern Pennsylvania for the Business Training Corporation of New York, specialists in training courses in production methods for foremen and production executives.

STANLEY T. GOSS, until recently vice president and sales manager of the New Britain Machine Co., has joined the staff of A. L. DeLeeuw, consulting engineer, as business manager.

E. E. HOFFMAN, of New York, has been appointed plant engineer of the Hendee Manufacturing Co., motorcycle producers, Springfield, Mass. He will have supervision of product design, tools and tool design, maintenance, inspection, material specifications and standardization.

C. H. SAWYER, formerly Rochester manager for the Syracuse Supply Co., and later connected with its Syracuse office, has taken charge of the Syracuse office of D. R. Clarkson and Co., Machine Tool Dealers, of Rochester.

COL. C. L'H. RUGGLES, the head of the technical division of the Ordnance Department, is acting as chief of Ordnance during the absence of Gen. C. O. Williams.

Obituary

FREDERICK E. ANTHONY, who for many years was in charge of the automatic screw machine tool designing at the Brown & Sharpe Manufacturing Co., died October 8, on his fifty-eighth birthday. Mr. Anthony was born in East Providence, and at the age of seventeen entered Brown & Sharpe's employ as an apprentice. He remained with the company until January, 1890, after which he worked with the Eastman Kodak Company and with Bugbee & Niles, of North Attleboro. In October, 1898, he again returned to the employ of the company, where he remained up to the time of his death. He represented the type of a trained mechanic which has made so much for the progress of mechanical lines in this country. He was fertile in devising ways and means of doing work, and his sound mechanical judgment and training kept him from various pitfalls that are so apt to embarrass a mechanical genius. Through his advice and experience, many of the details of the automatic screw machines were brought out.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Engineering machinery and machine-tool lines—Belgium and France. Agency desired by a Belgian engineer now in the United States. Reference No. 3814.

Structural steel, window panes, plumbing equipment, light hardware, and bricks and plaster for a municipal building—Mexico. Correspondence should be in Spanish. Reference No. 3815.

Printing types and printing presses—India. Purchase is desired. Reference No. 3824.

Sheet aluminum for the manufacture of kitchen utensils—Italy. Purchase desired. Quotations, c.i.f. Italian port. Reference No. 3834.

Machinery and engineering supplies—New Zealand. Purchase and agency desired. Quotations, c.i.f. Australasian ports. Reference No. 3840.

Machinery for the manufactuer of glue, including equipment for solidifying and cutting gelatin, vacuum tanks, and dryers—Chile. Purchase desired. Quotations, c.i.f. Valparaiso. Reference No. 3841.

Small motor-driven irrigation pumps for farms, larger pumps for deep wells, and small centrifugal pumps—Greece. Purchase desired. Quotations, f.o.b. New York. Reference No. 3822.

Olive oil refining plant complete—Spain. Purchase desired. Quotations, c.i.f. Spanish port. Correspondence, Spanish. Reference No. 3842.

Popcorn machines—Mexico. Purchase desired. Catalogues and prices are requested. Reference No. 3843.

Machinery for distilling fruit essences—India. Purchase and agency desired. Quotations, c.i.f. Bombay. Terms, payment against documents. Reference No. 3844.

Carborundum powder—Japan. Purchase desired. Samples and prices are requested. Reference No. 3847.

Hardware, such as wood screws, wire nails, rose nails, bolts and nuts, rivets, files, and tool steel; cotton-mill stores; electrical goods and accessories; all kinds of tin and wooden ware; mechanical toys—India. Agency desired. Reference No. 3863.

Glassware, enamel and aluminum ware, lamp ware, safes, cutlery, hardware, rice mills and machinery, and sundries—India. Purchase desired. Terms, payment against documents. Reference No. 3870.

Wire, screws and hinges for bed springs—Spain. Purchase desired. Quotations, f.o.b. New York. Correspondence, Spanish. Reference No. 3873.

Machines for the preparation of popcorn for confections—Belgium. Agency desired. Reference No. 3879.

Galvanized chains for vessels; and pulp-machine wires—Norway. Agency desired. Quotations, f.o.b. New York. Payment to be arranged through Norwegian bank. Reference No. 3880.

Steel tubes, fittings, valves, and all similar steel and iron products—Netherlands. Agency desired from manufacturers. Quotations, f.o.b. American port. Payment, cash against documents. Reference No. 3893.

Trade Catalogs

Condensed Catalog of Mechanical Equipment. Issued by the American Society of mechanical Engineers. The catalog is now 9 x 12 in., the size of *Mechanical Engineering*, and is bound in limp covers. It contains 622 pages on thin paper and includes a general classified directory as well as a directory of consulting engineers.

Books on Practical and Radio Subjects. The Norman W. Henley Publishing Co., 2 West 45th St., New York City. This company has just issued for free distribution a new catalog of their practical books on various subjects, including their latest publications on Radio matters.

Centrifugal Pumps. The Coeur d'Alene Hardware and Foundry Co., Wallace, Idaho. A new publication, known as Bulletin No. 21, has just been issued by this company. It contains a complete description with detailed illustrations of the company's line of single stage, single suction volute centrifugal pumps for slime, sand and water. The bulletin also contains several useful tables on hydraulics.

Friction Clutches and Transmission Equipment. McMahon & Co., Worcester, Mass. An illustrated bulletin covering the various types of friction clutches, counter-shafts and pulleys manufactured by this company.

Nitrol. The American Kreuger and Toll Corporation, 522 Fifth Ave., New York City. This company has recently issued a new folder on the subject of nitrol, a hardening agent for iron and steel. The folder gives a full description of the product with numerous micro-photographs showing the effect of the agent on steel under varying conditions.

Automatic Regulators. Charles Engelhard, Inc., 30 Church St., New York City. A new publication known as Bulletin 24, of catalog P-3 containing fourteen pages has just been issued by this company. The publication contains complete descriptive matter with illustrations on the various types of thermo electric pyrometers, electric resistance thermometers, regulating units, etc., made by this company.

Motor Grinders and Buffs. The J. G. Blount Co., Everett, Mass. A booklet containing complete information regarding the numerous types and sizes of motor grinders and motor buffs produced by this company.

Pamphlets Received

Economic Development of Shantung Province, China. Trade information bulletin No. 70 of the Department of Commerce on the economic conditions in Shantung province, transmitted by the American Consul at Tsinau. Distributed by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

International Association of Public Employment Services. Bulletin No. 311, of the Bureau of Labor Statistics, Department of Labor, containing the proceedings of the ninth annual meeting of the International Association of Public Employment Services, held at Buffalo, N. Y., September 7 to 9, 1921.

Digest of Patent Laws of the World. The Midas Trade Mark and Patent Bureau, Ellsworth Building, Chicago, Ill. This bureau has just issued a new folder, known as Bulletin No. 106, containing a digest of the patent laws of the world. In concise form, information is contained on such matters as duration, proper applicant, filing limitation, tax periods and patent workings in every country. There is also presented a graphic chart of U. S. patent procedure.

Sampling and Analysis of Pig Iron. The Carnegie Steel Co., Bureau of Technical Instruction, Pittsburg, Pa. This company has just issued a 40-page pamphlet covering the methods employed by the chemists of the U. S. Steel Corporation for the sampling and analysis of pig iron. The publication, one of a series of seven thus far issued by the Bureau, contains a complete description of the various methods of procedure followed in the determination of the various constituents of pig iron. A circular of information regarding this pamphlet, as well as the other six publications on kindred subjects, may be had on application to the Bureau of Technical Information, Carnegie Steel Co., Pittsburg, Pa.

Forthcoming Meetings

National Hardware Association of the United States. Convention, Atlantic City, N. J. Oct. 17, 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. T. James Fernley, secretary-treasurer, 505 Arch Street, Philadelphia, Pa.

American Hardware Manufacturers' Association. Convention, Atlantic City, N. J., Oct. 18, 19, 20, 1922. Headquarters, Marlborough-Blenheim. F. D. Mitchell, secretary-treasurer, 1819 Broadway, New York.

National Association of Farm Equipment Manufacturers. Annual Convention, October 18 to 20, Congress Hotel, Chicago.

Society of Industrial Engineers. Oct. 18 to 20. McAlpin Hotel, New York. Secretary, George C. Dent, 327 South LaSalle St., Chicago.

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Tin quoted at 34¼c. as against 33c.; zinc sheets, 9½c. advanced from 9¼c. and solder (½ and ½) 25½c. as compared with 25c. per lb., one week ago, in New York warehouses. Lead, 6.3c. as against 6¼c. in East St. Louis. Increasing demand for tin plates; price tendency upward. Aluminum ingots up 2c. in Cleveland; babbitt metal also advanced, 1½c.@1¾c. per lb. Zinc showing upward trend. Linseed oil prices firm; tending upward.

Declines—Structural shapes and soft steel bars, $2.15@$2.25 f.o.b. Pittsburgh, on ordinary tonnages; $1.90@$2, however, quoted on large orders. Plates, $2@$2.15; with undesirable specifications at a minimum of $2.25 per 100 lb. Substantial increase in discounts on rubber and duck belting, in New York warehouses. No. 2 foundry pig iron down $3 in Philadelphia and $1 in Pittsburgh; basic declined $2.50 per ton in Philadelphia.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$30.55
Northern Basic	32.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	28.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	33.64
Virginia No. 2	37.17
Basic	29.50
Grey Forge	32.00
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	34.00
Basic	33.00
Bessemer	33.00

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cincinnati	9.0	6 0	5@5½
Cleveland	8.0	5.25	4.5
Chicago	6.0	5.0	4.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 50@2.75	4.19	3.70	4.00
No. 12	2.60@2.85	4.24	3.75	4.05
No. 14	2.70@2.90	4.29	3.80	4.10
No. 16	2.90@3.20	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85

Galvanized	Pittsburgh	New York	Cleveland	Chicago
Nos. 10 and 11.	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.15	5.30	4.80	....
Nos. 22 and 24.	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.10	5.55
No. 28	4.35@4.75	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	68	56½	¾ to 1½	34	19
LAP WELD					
2	61	49½	2	29	15
2½ to 6	65	53½	2½ to 4	32½	19
7 to 8	62	49½	4½ to 6	32½	19
9 to 12	61	48½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	66	55½	¾ to 1½	34	20
2 to 3	67	56½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	59	48½	2	30	17
2½ to 4	63	52½	2½ to 4	33	21
4½ to 6	62	51½	4½ to 6	32	20
7 to 8	58	45½	7 to 8	25	13
9 to 12	52	39½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded.	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
3/32	8.00		12@13
⅛	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.75
Tin, 5-ton lots, New York	34.25
Lead (up to carlots), St. Louis.... 6.30; New York.	6.75@.6.87½
Zinc (up to carlots), St. Louis..... 6.65; New York.	7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.00	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.50	10.25	.....
Solder (½ and ½), (caselots)	25.50	23.50	20.00
Babbitt metal (83% tin)	34.00	44.00	36.00
Babbitt metal (35% tin)	25.00	17.25	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	12.00	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3 00	4.00	.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.00	7.25
IC,	14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.93	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 12.75	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville...per net ton		12.00@12.50	
Coke, prompt foundry, Connellsville...per net ton		13.50@14.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	5.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.35
Cone heads, ditto (net)	5.10	4.00	3.45
1¼ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—G. W. Kaull, 2134 Clark St., (machine shop)—forced feed rolling machine.

Ill., Chicago—J. H. Kruse, 2012 Chase Ave.—Hartley Universal coiling machine for machine shop.

Me., Portland—The Wright Moses Motor Co., 122 High St.—equipment for proposed garage on Forest Ave.

Mass., East Milton—Wadsworth & Jones, Adams St.—tools and equipment for proposed garage.

Mass., Somerville—Somerville Sales & Service Co., Highland and Willow Aves.—machinery, tools and equipment for proposed garage.

Mich., Iron River—Lindwall & Lindstrom (garage—repair shop machinery, including drill press and also air tanks.

Minn., Minneapolis—City Water Dept., City Hall, K. E. Alexander, City Purch. Agt.—will receive bids in about a month for one metal lathe for repair work, one small circular saw for carpenter, one power hammer, one drill press and grinding apparatus for proposed shop building.

Mo., Joplin—The Norton Taxicab Co., 520 Wall St., V. Norton, Purch. Agt.—complete garage machine shop equipment.

Mo., St. Louis—Schmidt Bros., 4371 Laclede St., (machine shop)—electric drill.

N. J., Garfield—De Matia Bros.—small radial drill press, between 8 and 8½ ft.

N. Y., Brooklyn—S. O. S. Welding Corp., 235 6th St.—one 8 ft. horizontal plate bending roll, and one small traveling crane.

N. Y., Buffalo—G. C. Kline, 2257 Niagara St.—small tools, etc., for addition to automobile repair shop.

N. Y., Buffalo—H. Knauss, 60 Saratoga St.—machinery and equipment for proposed 1 story garage and repair shop.

N. Y., Dunkirk—J. A. Wolpert, 210 Main St.—machinery, tools and equipment for garage and repair shop, to replace that which was recently destroyed by fire.

N. Y., Rochester—The Rochester Taxicab Co., 195 St. Paul St.—machinery, tools and equipment for $75,000 garage and service station.

N. Y., Rochester—C. F. Spies, 663 Winton Rd.—small tools, accessories, etc., for gas and service station at 669 Winton Rd.

O., Canton—The National Pressed Gear Co., 222 Cleveland Ave.—additional machinery for drop forged gear plant.

O., Cincinnati—The G. C. Dom Supply Co., 125 East Pearl St.—30 in. foot power tinners squaring shears.

Ore., Portland—R. S. Hughson, 10th and Couch Sts.—one machine turret lathe, 11 to 13 in. swing, with accessories and tools; 6 large size liquid fire extinguishers; one tool post grinder; one oxy-acetylene welding outfit.

Pa., Centerville—L. D. and L. L. Saunders—machinery, tools and equipment for proposed garage and service station.

Pa., Phila.—A. F. Hendricks Co., 907 Locust St., (sheet metal manufacturing products)—metal working machines.

Pa., Phila.—Humphrey & Co., Front St. and Tusculum Ave.—punches, shears, drills, etc., for steel plant.

Pa., Phila.—H. F. Munro, 1737 North 5th St., (sheet iron and metal products)—drill presses, punches, riveting machines, shears, etc.

Pa., Phila.—Pennsylvania R.R., Broad St. Sta., M. Smith, Purch. Agt.—one journal and axel lathe.

Pa., Pittsburgh—The Carnegie Steel Co., Carnegie Bldg.—drill press, pipe machines, grinder and woodworking machinery for new byproduct plant.

Pa., Pittsburgh—The Du Roth Steel Truck & Car Wheel Co., Keystone Bldg., A. Du Roth, Purch. Agt.—one 10 ton, one 5 ton and one 2 ton crane, also chain blocks, belting, shafting, lathes and presses.

Pa., Williamsport — S. T. McCormick, 3rd, 313-315 Hepburn St.—machinery, tools and equipment for $23,000 garage.

Tex., Electra—Magnolia Petroleum Co. (petroleum refiners)—machine shop equipment.

Wis., Appleton—Outagamie County, Court House, A. G. Brusewitz, Chn.—one 16 in. x 8 ft. lathe equipped for thread cutting, taper attachments, backing off attachments and straight tool holder; one Dunmore grinder for use on lathe; one milling machine equipped with arbor, vise and dividing head; one shaper; one small high speed drill press; one drill press for paper shank equipped with check to take up to ¾ in. straight shank drills; one large emery stand; one 10 ton traveling crane; one 5 gal. gas pump and 800 gal. tank; five 120 gal. oil storage tanks, complete with pumps, barrel rake and chain hoist.

Wis., Burlington—J. A. Alby & Son Co., (garage)—power saw, lathe, gasoline storage tanks and pump.

Wis., Eau Claire—Garton Bros. Co., 227 Chestnut St., E. F. Garton, Mgr.—automobile repair machinery.

Wis., Madison—W. Mead, 201 Science Hall—one lathe, motor driven.

Wis., Milwaukee—Pabst Corp., 917 Chestnut St., H. W. Marsh, Secy.—nipple cutting and threading machines for the manufacture of nipples for galvanized iron pipe.

Wis., Rhinelander—J. Segerstrom & Co., (garage)—automobile repair machinery.

Wis., Sarona—A. J. Henderson—garage and blacksmith shop equipment to replace that which was destroyed by fire.

Machinery Wanted

Ala., Gadsen — Bd. Educ. — vocational equipment for proposed $200,000 high school.

Calif., San Francisco—H. Wolger, 2222 Fillmore St., (cabinet maker)—trim saw and jointer for power equipment.

D. C., Wash.—A. L. Flint, Genl. Purch. Officer of the Panama Canal, Wash., D. C., receiving bids until Nov. 2, for steel, rivets, bolts, nails, section cars, mowing machines, brass sheets and tubing, copper tubing, boiler tubes, pig tin, valves, etc.

Ind., Indianapolis—Gem Laundry Co., 241 Indiana Ave.—machinery and equipment for $40,000 addition to laundry.

Ia., Dubuque—Bd. Educ., 245 B. and I. Bldg., L. Palen, Secy.—wood working machinery, including band saw, circle saw, mortiser, etc., for manual training department.

Kan., Wichita—C. F. Lewis, 713 Ohio St. (machine shop)—welding outfit, air compressor, emery stand, wheel, electric motor, belting, shafting and hangers.

Ky., Ashland—S. S. Willis—machinery and equipment for proposed brick plant at Summit.

Ky., Louisville—The Pyne Co., 927 Shelby Parkway—power punch and T. and L. pulleys.

Ky., Russellville—Independence Nitro Co.—complete machinery and equipment for proposed plant for the manufacture of nitroglycerin, capacity 800 qts. per day.

Ky., Whick—Noble Coal & Lumber Co., G. Noble, Pres.—electrical and mechanical mining equipment for mines.

Ky., Williamsburg—The Iroquois Natural Gas Co. — machinery and equipment for proposed plant for the manufacture of carbon black.

Md., Baltimore — D. C. Elpinstone, 408 Continental Bldg.—one electric locomotive crane suitable for handling a 2 cu. yd. bucket.

Mass., Brighton (Boston P. O.)—Cambridge Cement Stone Co., 156 Lincoln St.—concrete block machinery, also miscellaneous tools for repairs.

Mass., Fairhaven—The Atlas Tack Co.—Complete equipment for proposed tack manufacturing plant at St. Louis, Mo.

Mass., Natick—Natick Box Co., C. A. Coombs, Owner—woodworking and box making machinery of various kinds.

Mass., Somerville—Hoghosian Bros., 19 Simpson Ave. — machinery for candy factory.

Mich., Marshall—The Chronicle—printing press.

Mich., Republic—Cleveland Cliffs Iron Co.—blacksmith shop equipment.

Minn., Minneapolis—The Pillsburg Milling Co., 302 Metropolitan Life Bldg., A. C. Loring, Pres.—machinery, including conveying and handling machinery, for proposed $2,500,000 flour mill at Buffalo, N. Y.

Minn., Morris—The City, F. J. Haight, Mgr. of Waterworks—crane for pump station.

Miss., Jackson—The Clarion Ledger—model K linotype.

Mo., Joplin—The Carlson Printing Co., 618 Joplin St., A. C. Carlson, Purch. Agt.—complete job printing equipment, including job presses, belting, hangers, pulleys and bearings.

Mo., St. Louis—Pevely Dairy Co., 1001 South Grand St.—paper cutter with 26 in. blade.

Mo., St. Louis—The Rebstock Co., 1439 North 19th St.—conveyors, gravity rollers, belting, belt and collar conveyors.

N. Y., Binghamton—The Nineteen Hundred Washer Co., 205 Clinton St., (manufacturer of washing machines), P. J. Bickel, Secy.—additional machinery for proposed increase in output.

N. Y., Bowmansville—The Bowmansville Creamery, Inc., A. Snell, Purch. Agt.—equipment for refrigerating and creamery plant.

N. Y., Brooklyn—H. J. Wheeler Salvage Co., 224 Bush St.—low pressure compression cylinder, not less than 24 in. nor more than 36 in.

N. Y., Buffalo—Automatic Gear Co., 712 Erie County Bank Bldg., F. E. Freedman, Purch. Agt.—machinery for the manufacture of gears.

N. Y., Buffalo—The Eagle Bottling Wks., 415 Sycamore St., H. Cohen, Purch. Agt.—equipment for the manufacture of beverages.

N. Y., Buffalo—N. B. Falls Lubrication Co., 103 Manitoba St., N. B. Falls, Genl. Mgr.—three 12,000 gal. capacity each, gasoline and kerosene storage tanks, to be of 5/16 and ¼ in. metal, suitable for mounting upon wooden standards.

N. Y., Buffalo—The Gebhard Paper Co., 178 Ellicott St., A. Gebhard, Purch. Agt.—one 44 in. automatic paper cutter, one lever cutter and other printing equipment.

N. Y., Buffalo—P. J. Gunn, 80 Elk St.—machinery and equipment for battery service and engineering station.

N. Y., Buffalo—The Hall Paint Co., 143 Grape St.—equipment for the manufacture of paint.

N. Y., Buffalo—W. F. Hoffman, 23 Poplar St.—machinery and equipment for woodworking shop, including band saw, combination saw, lathe and cutoff saw.

N. Y., Buffalo—The Stabryte Steel Co., Inc., 8 Lord St., H. E. Bredemeier, Purch. Agt.—machinery for the manufacture of hardware and cutlery.

N. Y., Corning—Corning Hospital—mechanical and laundry equipment for proposed laundry.

N. Y., Jamestown — The International Casement Co., 84 Hopkins Ave., (manufacturer of steel window frames, etc.)—additional machinery for addition to factory.

N. Y., Jamestown—Jamestown Worsted Mills Co., 335 Harrison St.—machinery and equipment for proposed 1 and 2 story addition to mills.

N. Y., Jamestown — Watson Mfg. Co., Taylor St., (manufacturer of steel window and door screens)—additional machinery for four story addition to factory.

N. Y., Lockport—The Harrison Radiator Co., Washburn St.—machinery and equipment for proposed 3 story addition to radiator factory.

N. Y., New York—Acme Lighting Fixture Co., 107 West 13th St.—plating tank.

N. Y., New York—M. Buschbaum, 15 Park Row—Mayo knitting machines, 16 or 17 needles.

N. Y., New York—A. Loewy, 200 5th Ave., (machinery)—baling machine.

N. Y., Perry—The Fanning Co., Inc., (ice manufacturers) — refrigeration machinery and equipment for proposed 1,800 ton ice plant.

N. Y., Poughkeepsie—The Central Hudson Gas & Electric Co., 50 Market St.—small grinding outfit which will operate on ordinary lamp socket.

N. Y., Spencerport—J. E. Hay—one hand soleing machine and one stitching machine.

O., Akron—Rauschenberger Tire Co.—rubber working machinery for its auto tire factory at Granville, Wis.

O., Cleveland—Merit Motor Co., East 65th and Cedar Sts., (manufacturers of automobiles)—machinery and equipment for proposed plant at Niagara Falls, Ont.

O., Columbus—National Ice & Storage Co., 5th and Naghten Sts.—$10,000 worth of special ice machinery, electrically driven.

O., Lancaster—The Fairfield Eng. Co.—machinery and equipment for the manufacture of coal loading machinery, to replace that which was destroyed by fire.

O., Sebring—The Crescent China Co.—machinery and equipment for china ware manufacturing plant, including jigger shop, coal loading plant, kilns, etc.

O., Warren—H. W. Ward, North Mahoning Ave., (greenhouses) one large power driven feed cutting machine.

Okla., Eufaula—F. M. Billings—one 2 page, 7 column cylinder press for newspaper work.

Okla., Ponca City—Bd. Educ.—vocational equipment for proposed $200,000 high school.

Pa., Boyertown — Eastern Fdry. Co.—equipment for 1 and 2 story foundries.

Pa., Johnstown—Bd. Educ.—machinery for vocational department of proposed high school.

Pa., Lancaster — Fleck-Marshall Co., (manufacturer of plumbing supplies)—machinery and equipment for plant at Williamsport.

Pa., Marwood—Highland View Mfg. Co., (manufacturer of wood and metal specialties), J. Whewell, Pres.—machinery and tools, incl. hammers, nickel steel, etc., for proposed plant (under construction).

Pa., Phila.—Brehem & Stehle, Trenton and Allegheny Aves., (dyers) W. H. Brehem, Purch. Agt.—dryers, extractors, etc., for proposed dye plant.

Pa., Phila.—Dept. of Pub. Safety, 1328 Race St.—1 ton electric cable hoist.

Pa., Phila.—Dolfingers Standard Dairies, 16th and Tasker Sts.—refrigerating machines, sterilizers, bottle washing and filling machinery.

Pa., Phila.—G. J. Littlewood & Sons, Main St. and Walnut Lane, (dye and bleechers)—centrifugal dryers, extractors and other bleaching machinery.

Pa., Phila.—Roosevelt Worsted Mills, 2023 Naudain St., F. Quitner, Purch. Agt. Machinery for—looms, cards, combs, etc.

Pa., Phila.—M. L. Shoemaker & Co., Venango St. and Delaware Ave., (fertilizer manufacturers)—grinders, maceraters, etc., for plant.

Pa., Pittsburgh—H. J. Heinz, 1062 Progress St., N. S., (pickles and preserves)—one 2 ton crane.

Pa., Pittsburgh — Kund & Elben Mfg. Co., 204 Warrington Ave., (cabinet makers)—woodworking machinery, direct driven from individual motors.

Pa., Pittsburgh—Neely Nut & Bolt Co., 26 South 22nd St.—one 60 ft. span 5 ton crane.

Pa., Pittsburgh—Pittsburgh Valve Fdry. & Constr. Co., Penn Ave.—one 5 ton crane.

Pa., Scranton—Nagelberg & Fiegenbaum, 1005 Capouse St.—machinery and equipment for clothing and underwear factory.

Pa., Warren—C. Hamm, 28 Clark St.—wood working machinery.

Pa., Warren—The Seneca Oil Wks., South Carver St.—machinery and equipment for proposed addition to refinery.

Pa., Williamsport—Williamsport Building Products Co., 1603 Erie Ave.—additional machinery and equipment for proposed building products factory.

Pa., York—Markel Hall Hosiery Mills—Scott & Williams knitting machines, Model B-5.

Tenn., Knoxville—The Appalachian Marble Co., Inc., P. O. Box 837—pumping outfit, prefer direct connected turbine set, capacity 50 gal. per minute against a head of 85 to 100 lb. gauge pressure.

Tenn., Memphis—Clover Farm Dairy Co., 789 Union Ave—$70,000 worth of modern machinery for creamery, dairy and ice cream factory.

Va., Richmond—J. W. Ferguson & Sons, 105 North 14th St., (printers)—one large Miehle press, folding machine and job presses.

Wash., Centralia—H. Staistedt, 412 North Diamond St.—one 150 to 200 lb. belt driven drop hammer.

W. Va., Wellsburg—The Hammond Bag & Paper Co., P. O. Box 467 — special bag machinery, hangers, pulleys, belting and shafting.

Wis., Algoma—Algoma Wood Products Co.—woodworking and special machinery, also power machinery.

Wis., Appleton—T. Heide, 685 Appleton St.—refrigerating machinery.

Wis., Madison—State Bd. of Control, Capitol, M. J. Tappins, Secy.—receiving bids until Oct. 24 for refrigerating machinery.

Wis., Merrill—Heineman Lumber Co., H. H. Heineman, Purch. Agt.—saw mill machinery, belting and shafting.

Wis., Milwaukee—Burleigh Hardware Co., c/o A. H. Butenhoff, 1400 28th St.—sheet metal working machinery, brake, etc.

Wis., Milwaukee—G. O. Dallmann, 375 Manitoba Ave., (woodwork)—circle saw with motor.

Wis., Milwaukee—W. A. Getzel, 1218 23rd Ave., (millwork)—trim saw.

Wis., Milwaukee—J. Jazwiecki, 849 Lincoln Ave., (bakery)—mechanical bake oven, electrical mixers, etc.

Wis., Milwaukee—J. H. Marshutz, 1005 Trust Co. Bldg.—overhead crane.

Wis., Milwaukee—Terner Metal Specialty Co., c/o J. Eder, 606 Caswell Blk.—stamping machine.

Wis., Milwaukee—Waukesha Dairy Co., 342 6th St.—dairy and refrigeration machinery for proposed addition to plant.

Wis., Park Falls—The Flambeau Paper Co., G. Walds, Mgr.—power and pulp mill machinery.

Wis., Plymouth—The Badger Cabinet Co.—woodworking and special machinery for chair factory at Pulaski.

Wis., South Milwaukee—The Burnham Bros. Brick Co., 68 Wisconsin St.—crane for proposed dryer plant.

B. C., Vancouver — J. Read, c/o Bridge River Power Co., 602 Hastings St., W.—machinery and equipment for proposed large pulp and paper mill.

Ont., Brantford—Brantford Arena Co., A. Ballyntyne, Pres.—ice making equipment for proposed arena.

Ont., Galt—Stauffer-Dobbie, Ltd., (carpets)—"Royle" Jacquard cutting machine.

Ont., Humberstone—Humberstone Shoe Co. Ltd., H. H. Knoll, Purch. Agt.—two 4 in. gearless sole cutting machines, one 5 hp. electric motor, 1 clicking machine, 60 ft. of 1$\frac{15}{16}$ in. shafting with hanger couplings, wooden shoe racks, etc.

Ont., London—The Corrugated Carton proposed factory.

Ont., St. Thomas—W. A. McIntyre, Chn. City Gas Comn.—equipment for gas plant.

Ont., Weston—Moffats Ltd., F. W. Moffat, Purch. Agt.—equipment for porcelain enameling department.

Que., Pointe aux Trembles — Parlor Furniture Mfg. Co. Ltd., Victoria St., G. Langelier, Purch. Agt.—woodworking machinery to replace that which was destroyed by fire.

Metal Working Shops

Calif., Oakland — The Chevrolet Motor Co., Foothill Blvd. and 69th Ave., awarded the contract for the construction of a 2 story, 80 x 684 ft. factory on Hillside Ave. and 72nd St. Estimated cost $300,000. Noted Oct. 12.

Calif., San Francisco — J. Madison, 112 Market St., has had plans prepared for the construction of a 3 story factory, on Harrison St. near Langton St.. Estimated cost $29,950. N. Blaisdell, 255 California St., Archt. Pacific Meter Co., 1123 Harrison St., lessee.

Calif., San Francisco — J. Pasqualetti, 785 Market St., awarded the contract for the construction of a 2 story garage, on O'Farrell St. near Steiner St. Estimated cost $38,900. Noted July 20.

Conn., Bridgeport—The Atlas Body Wks., Inc., 147 McKinley Ave., awarded the contract for the construction of a 1 story, 76 x 90 ft. addition to its factory and a 1 story, 15 x 30 ft. power house. Estimated cost $25,000. Noted Sept. 14.

Conn., Danbury—The Ball & Roller Bearing Co., 22 Maple Ave., awarded the contract for the construction of a 2 story, 50 x 114 ft. addition to its factory, on Maple Ave. and Crosby Sts. Estimated cost $40,000.

Conn., Plantsville—The Blakeslee Forging Co. is having plans prepared for the construction of a 2 story, 40 x 42 ft. addition to its forge shop. Estimated cost $15,000. Greenwood & Noerr, 847 Main St., Engrs. and Archts.

Conn., Waterbury—The Plume & Atwood Mfg. Co., 470 Bank St., manufacturer of brass goods, awarded the contract for the construction of a 1 story, 30 x 30 ft. addition to its factory. Estimated cost $5,000.

D. C., Wash. — The Lambert Hudson Motor Co., 1212 Connecticut Ave., awarded the contract for the construction of a service station on 22nd and M Sts., N. W. Estimated cost $150,000. W. E. Lambert, Pres.

Ill., Chicago—Kocher & Larson, Archts., 6250 South Halsted St., are receiving bids for the construction of a 1 and 2 story, 36 x 146 ft. addition to factory, for the Advance Fdry. & Pattern Co., 2734 West 36th St. Estimated cost $50,000.

Ind., Indianapolis — The Conduitt Automobile Co., 314 North Delaware St., awarded the contract for the construction of a 3 story, 63 x 200 ft. automobile sales and service station, on North Meridian Ave. Estimated cost $150,000. Noted Sept. 7.

Me., Portland—Clough & Maxim, Fidelity Bldg., will build a 1 story, 55 x 200 ft. automobile service station on Forest Ave. Estimated cost $40,000. Poor & Thomas, Brown Bldg., Archts. The Wright Moses Motor Co., 122 High St., Lessees.

Mass., East Milton—Wadsworth & Jones, Adams St., plan to build a garage. Cost between $15,000 and $18,000.

Mass., Fall River—The Bd. of Water Comrs. awarded the contract for the construction of a 2 story, 30 x 145 ft. machine shop on Bedford St. Estimated cost $40,000.

Mass., Lawrence—The Champion-International Paper Co., 38 Prospect St., is having plans prepared for the construction of a 1 story, 65 x 115 ft. machine shop. Estimated cost $30,000. Private plans.

Mass., Roxbury (Boston P. O.)—J. J. Walsh Co., 1540 Columbus Ave., is receiving bids for the construction of a 2 story, 50 x 100 ft. addition to its automobile body factory. Estimated cost $24,000. S. J. Rantin, 1117 Columbus Ave., Archt.

Mo., St. Louis—The Atlas Tack Co., Fairhaven, Mass., awarded the contract for the construction of a tack manufacturing plant, consisting of a 1 story, 203 x 503 ft. main plant, a 2 story, 25 x 203 ft. office building, 30 x 67 ft. and 30 x 187 ft. storage sheds, and also a 20 x 30 ft. transformer house, on Union and Geraldine Sts., here. Estimated cost $400,000.

N. Y., Buffalo—The Birk-Notman Motor Co., Inc., 828 Main St., plans to build a 1 story, 50 x 150 ft. garage on Hertel and Delaware Aves. Estimated cost $40,000.

N. Y., Lockport—The Harrison Radiator Co., Washburn St., is having plans prepared for the construction of a 3 story, 150 x 300 ft. addition to its plant. J. R. Tyler, 715 Union Trust Bldg., Rochester, Archt.

N. Y., New York—A. Revere, c/o H. J. Nurick, Archt. and Engr., 44 Court St., Brooklyn, will soon receive bids for the construction of a 3 story, 75 x 100 ft. garage at 531 West 36th St. Estimated cost $75,000.

N. Y., New York—The Transit Comn., 49 Lafayette St., will receive bids until Oct. 20, for furnishing and erecting steel, and building foundation for third addition to its shops at Lenox Ave. and 148th St.

N. Y., Rochester—F. J. Zorn, 64 North Plymouth Ave., is receiving bids for the construction of a 2 story, 100 x 212 ft. and 58 x 182 ft. garage at 195 St. Paul St. Estimated cost $75,000. Foote & Carpenter, State and Church Sts., Archts.

N. Y., Springville—A. C. Fisher plans to build a 50 x 100 ft. machine shop. Cost will exceed $5,000.

O., Canton—The National Pressed Gear Co., Crane Bldg., awarded the contract for the construction of the first unit of its proposed factory, 1 story, 50 x 175 ft., on Allen Ave., S. E. Estimated cost $200,000.

O., Cleveland—The R. and L. Baker Co., c/o K. E. Stahl, 2180 West 25th St., awarded the contract for the construction of a 1 story, 36 x 48 ft. kiln and a 69 x 112 ft. addition to its factory, for the manufacture of automobiles. Estimated cost $60,000.

O., Cleveland—The Gabriel Mfg. Co., 1401 East 40th St., awarded the contract for the construction of a 2 story, 60 x 160 ft. addition to its factory, for the manufacture of auto accessories. Estimated cost $60,000. C. Foster, Mgr.

O., Columbus — The Lawwell-McLeish Co., 97 North 4th St., awarded the contract for the construction of a 2 story, 63 x 94 ft. garage. Estimated cost $17,875. Noted Aug. 17.

O., Lancaster—The Fairfield Eng. Co. plans to build a factory for the manufacture of coal loading machinery, to replace the one which was recently destroyed by fire. Estimated cost $250,000.

O., Newburg Heights (Cleveland P. O.)—The Aluminum Manufacturers, Inc., c/o O. Tessier, 2210 Harvard Ave., plans to build a 2 story, 50 x 100 ft. factory. Estimated cost $50,000. Private plans.

Pa., Altoona—The Pennsylvania R.R., Broad St. Sta., Phila., plans to build a 1 story erecting and machine auxiliary shops on 16th St., and will also convert present roundhouse into a locomotive repair shop. A. C. Shand, Broad St. Sta., Phila., Ch. Engr.

Pa., Butler—Rieck McJunkin Dairy Co., Forbes St., Pittsburgh, will build a 2 and 3 story top addition to its garage and warehouse, on McKean and East Wayne Sts. Estimated cost $60,000. A. Daniels, c/o owner, Archt. Noted July 6.

Pa., Clairton—The Carnegie Steel Co., Carnegie Bldg., Pittsburgh, awarded the contract for the construction of an addition to its byproduct plant, consisting of over 200 byproduct ovens with full equipment, here. Estimated cost $2,000,000.

Pa., Juniata—The Pennsylvania R.R., Broad St. Sta., Phila., is having plans prepared for the construction of 1 story, 100 x 700 ft. erecting and machine auxiliary shops, here. Estimated cost $300,000. W. H. Cookman, Broad St. Sta., Phila., Archt. A. C. Shand, Ch. Engr.

Pa., Phila.—W. Fleming, 956 Foulkrod St., awarded the contract for the construction of a 1 story, 32 x 60 ft. machine shop, on Cottman and G Sts.

Pa., Phila.—C. E. Wunder, Archt., 1415 Locust St., is receiving bids for the construction of a 2 story, 60 x 144 ft. steel factory on Van Dyke St. and Torresdale Ave., for Humphreys & Co., Front St. and Tusculum Ave.

Pa., Pittsburgh—The Commercial Land Co., c/o A. H. Byers, 235 Water St., awarded the contract for the construction of a 4 story garage and office building on Rebecca St. and Baum Blvd. Estimated cost $175,000. Noted Aug. 3.

Pa., Pittsburgh—The Hanlon Gregory Galvanizing Co., 24th St., awarded the contract for the construction of a 1 story, 100 x 400 ft. mill, on 56th and Butler Sts. Estimated cost $100,000. Noted Oct. 5.

Pa., Pittsburgh—R. W. Hinkle, 601 Foreland St., and Buettner Bros., 3271 East St., awarded the contract for the construction of a 1 story, 30 x 110 ft. garage, at 21 and 23 Foreland St. Estimated cost $40,000.

Pa., Vandergrift—McCutcheon Bros. are receiving bids for the construction of a 1 story, 70 x 130 ft. garage on Washington Ave. and 12th Alley. Estimated cost $40,000. G. M. Rowland, Bakewell Bldg., Pittsburgh, Archt. Blum, Weldin & Co., Bakewell Bldg., Pittsburgh, Engrs.

Pa., Washington—Hazel Atlas Glass Co., South Main St., will build a 3 story, 44 x 79 ft. machine shop. Estimated cost $50,000. L. Meharg, c/o owner, Engr.

Pa., Washington—L. Snyder awarded the contract for the construction of a 1 story, 44 x 65 ft. machine shop. Estimated cost $10,000.

Pa., Williamsport—The Fleck Marshall Co., Lancaster, has purchased the Rothfuss Howard Iron Wks., on East 3rd St., here, and plans to build a 2 story foundry and machine shop. J. Fleck, 50 North 5th St., Phila., Pres.

Pa., Williamsport — The Williamsport Wire Rope Co. awarded the contract for the construction of a 1 story, 80 x 142 ft. addition to its factory, for the manufacture of wire rope and similar products. Estimated cost $10,000.

W. Va., Fairmont—F. W. McIntire plans to build a 2 story, 50 x 160 ft. garage. Private plans.

W. Va., Huntington—R. L. Day, Archt., 1st Natl. Bank Bldg., is receiving bids for the construction of a 1 story, 108 x 201 ft. addition to stamping plant, for the Armstrong Mfg. Co.

Wis., Appleton—P. Rademacher, 801 Superior St., will build a 1 story, 32 x 120 ft. garage. Estimated cost $40,000. Private plans.

Wis., Burlington—J. Alby & Son, will build a 2 story, 30 x 80 ft. garage. Estimated cost $40,000. Noted Aug. 29.

Wis., Eau Claire—Garton Bros. Co., 227 Chestnut St., awarded the contract for the construction of a 1 story, 50 x 100 ft. garage on Madison St. Estimated cost $40,000. E. F. Garton, Mgr.

Wis., Kewaunee—The Leyse Aluminum Co. plans to build a 2 story, 75 x 160 ft. factory for the manufacture of aluminum products. A. B. Leyse, Pres. Architect not selected.

Wis., Kohler—Brust & Philipp, Archts., 405 Bway., Milwaukee, are receiving bids for the construction of a 4 story, 70 x 160 ft. factory for the manufacture of plumbing fixtures, here, for Kohler Co. Estimated cost $75,000.

Wis., Madison—The University of Wisconsin plans to build a 1 story, 60 x 95 ft. machine shop, for use in the department of engineering, on Breeze Terrace. M. E. McCoffery, Secy. Architect not selected.

Wis., Marinette— C. Anderson & Sons, Cook and Merryman Sts., are having plans prepared for the construction of a 2 story, 50 x 75 ft. factory for the manufacture of brick conveyors. Estimated cost $75,000. Private plans.

Wis., West Bend—The Amer. Service & Storage Garage, c/o M. A. Johennes, is having plans prepared for the construction of a 2 story, 60 x 80 ft. garage. Estimated cost $40,000. L. Hunt, 445 Milwaukee St., Milwaukee, Archt.

Ont., Niagara Falls—The Cameron Motor Co., Cleveland, O., plans to build a branch factory, here.

Ont., Niagara Falls—D. W. Robert Mfg. Co., Lockport, N. Y., will receive bids about March 1 for the construction of a 1 story, 40 x 80 ft. factory, for the manufacture of knives for paper cutting, here. Estimated cost $5,000. Architect not announced.

Ont., Toronto — The Toronto Hardware Mfg. Co., 402 Dufferin St., plans to build a factory. Estimated cost $60,000. Architect not selected.

Ont., Weston—Moffatts Ltd. awarded the contract for the construction of a 2 story, 60 x 100 ft. addition to stove factory. Estimated cost $60,000.

General Manufacturing

Calif., Petaluma—B. Jones, Archt., Petaluma, is receiving bids for the construction of a packing plant, for the Poultry Producers of Central California, 323 East Washington St. Noted Oct. 5.

Calif., San Francisco — The Legallett-Hellwig-Norton Co., 1600 Fairfax Ave., awarded the contract for the construction of a 3 story, 50 x 105 ft. factory for tanning plant. Estimated cost $12,000.

Calif., San Francisco—C. E. Lewis, 306 Sacramento St., has had plans prepared for the construction of a 2 story, 25 x 120 ft. glove factory, on 6th St. near Folsom St. Estimated cost $6,500.

Calif., Taft—Cottage Laundry, 322 Main St., plans to build a 1 and 2 story laundry. Estimated cost $50,000. B. Mills, owner. Architect not selected.

Conn., Bridgeport — Fletcher-Thompson, Inc., Engrs. and Archts., 542 Fairfield Ave., are receiving bids for the construction of a 3 story, 60 x 110 ft. addition to ice cream plant, for the Huber Ice Cream Co., 800 Seaview Ave. Estimated cost $150,000.

Conn., East Lyme—The Niantic Mfg. Co. awarded the contract for the construction of a 1 story, 30 x 30 ft. addition to its woolen mill. Estimated cost $5,000.

D. C., Wash.—N. Auth Provision Co., 633 D St., awarded the contract for altering and building an addition to its plant. Estimated cost $74,950.

Ill., Chicago—A. S. Alschuler, Archt., 28 East Jackson Blvd., is receiving bids for the construction of a 3 story, 100 x 300 ft. candy factory, on Cicero and Kinzie Sts., for E. J. Brach & Sons, 215 West Ohio St. Estimated cost $1,000,000. Noted Sept. 14.

Ill., Chicago—The Bassick Mfg. Co., 2638 North Crawford Ave., is having plans prepared for the construction of a 1 story, 55 x 142 ft. factory for the manufacture of lubricating oils, on North Homan Ave. R. S. Ostergren, 155 North Clark St., Archt.

Ill., Chicago—The Valentine Seaver Co., 1721 Sedgewick St., awarded the contract for the construction of a 4 story, 103 x 171 x 272 ft. furniture factory, on Greenview and Wrightwood Sts. Estimated cost $400,000. Noted Oct. 12.

Ind., Borden—The Indiana Borden Cabinet Co. plans to build a 2 story addition to its furniture factory. Estimated cost $35,000. Architect not selected.

Ind., Indianapolis—The Enquirer Printing Co., 309 East Ohio St., awarded the contract for the construction of a 2 story, 55 x 93 ft. printing plant. Estimated cost $25,000. Noted Sept. 14.

Ind., Madison—The Pearl Packing Co. plans to build a 1 story, 56 x 129 ft. packing plant. Estimated cost $26,000. M. P. Burt Co., Falls Bldg., Memphis, Tenn., Engr.

Ky., Williamsburg—The Iroquois Natural Gas Co. plans to build a large plant for the manufacture of carbon black. Estimated announced.

Mass., Cambridge—The Boston Woven Hose & Rubber Co., 15 State St., awarded the contract for the construction of a 1 story, 43 x 82 ft. factory. Estimated cost $20,000.

Mass., East Lee—The Mountain Mill Paper Co. will build a 2 story, 35 x 60 ft. addition to its mill.

Mass., Watertown — The Hood Rubber Co., Nichols Ave., will build a 1 story, 50 x 150 ft. addition to its vulcanizing plant. Estimated cost $7,500.

Mass., Watertown—Vose & Sons Piano Co., 1010 Massachusetts Ave., Roxbury, is having plans prepared for a piano factory on School and Arsenal Sts., here. Estimated cost $300,000. Densmore & LeClear, 88 Broad St., Boston, Archts.

N. Y., Buffalo — The Pillsbury Milling Co., 302 Metropolitan Life Bldg., Minneapolis, Minn., will receive bids about March 1 for the construction of a large flour mill, capacity 7,000 bbl. per day, here. Estimated cost $2,500,000. A. C. Loring, Pres. Architect not announced.

N. Y., Jamestown — The Jamestown Lounge Co., 40 Winsor St., will build a 6 story, 102 x 144 ft. addition to its factory. Noted Oct. 12.

N. Y., Perry—The Fanning Co., Inc., has awarded the contract for the construction of an 1,800 ton ice plant.

N. Y., Yonkers—Alex Smith & Sons, Elm Ave., awarded the contract for the construction of a 4 story, 130 x 136 ft. spinning mill, a 2 story, 50 x 150 ft. yarn storage building, 1 story, 75 x 200 ft. waste storage building and 1 story, 30 x 60 ft. dye house. Estimated total cost $300,000.

O., Cleveland — The Excelsior Varnish Co., 1242 West 74th St., awarded the contract for the construction of a 2 story, 30 x 42 ft. factory. Estimated cost $25,000. J. C. Vick, Mgr.

O., Cleveland—The Mechanical Rubber Co., c/o A. C. Kingston, Mgr., foot of Lisbon Rd., awarded the contract for the construction of a 3 story, 40 x 50 ft. factory. Estimated cost $40,000.

O., Cleveland — The Whitmer-Jackson Sash & Door Co., 1996 West 3rd St., has had plans prepared for the construction of a 2 story, 70 x 151 ft. addition to its lumber mill. Estimated cost $40,000. S. H. Whitmer, Pres. H. M. Morse, Finance Bldg., Archt.

O., Columbus—National Ice & Storage Co., 5th and Naghten Sts., is having plans prepared for a 2 story ice factory on West Broad St. Estimated cost $20,000. Bassett & Tressell, Citizen's Bank Bldg., Archts.

Pa., Jacobs Creek—The United States of America Drug & Chemical Co. is receiving bids for the construction of a 3 story, 72 x 120 ft. drug and chemical factory. Estimated cost $150,000. P. Rossello, 406 Congress Bldg., Detroit, Mich., Archt.

Pa., Kane—The Sakura Soap Co., will build a 1 story, 45 x 126 ft. addition to its factory. E. A. Phillips, Warren Trust Bldg., Warren, Pa., Archt.

Pa., McKees Rocks — The Chesebrough Mfg. Co., 17 State St., New York City, awarded the contract for the construction of a 2 story, 106 x 143 x 190 x 195 ft. finishing building, a 1 and 2 story, 31 x 103 ft. tank house, and a 1 story, 36 x 39 ft. boiler house, here. Estimated cost $200,000. This is the first unit of proposed $1,000,000 manufacturing plant. Noted Oct. 5.

Pa., Oakmont—Mills, Rhines, Bellman & Nordhoff, Archts., 1234 Ohio Bldg., Toledo, O., are receiving bids for altering and constructing a 2 story, 74 x 94 x 157 x 158 ft. addition to paper bag factory, here, for the Valve Bag Co. of America, 3444 Summit Ave., Toledo, O.

Pa., Phila.—The Logan Ice Co., 10th and Windrim Sts., awarded the contract for the construction of a 1 story, 96 x 182 ft. ice manufacturing plant, consisting of 4 buildings.

Pa., Phila.—The Standard Provision Co., Callowhill and Willow Sts., awarded the contract for the construction of a 3 story, 70 x 160 ft. packing plant. Estimated cost $120,000. Noted Aug. 29.

Pa., Rossmere (Lancaster P. O.)—Rowe-Stuart Motors Corp. awarded the contract for the construction of a 1 story, 120 x 300 ft. factory, for the manufacture of special pneumatic tires and other rubber automobile goods.

Pa., Warren—C. Hamm, 28 Clark St., will build a 2 story, 35 x 120 ft. woodworking shop, to replace the one destroyed by fire.

Pa., Warren—The Seneca Oil Wks., South Carver St., plans to build a new cracking plant in connection with its refinery, for the manufacture of gasoline from low grade oil. Estimated cost $60,000. Architect not

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International Standardization

The Four Stages of Industrial Standardization—National and International Bodies—Examples of Accomplishment—Information the Basis of Co-operation

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IN DISCUSSING so complex a subject as international standardization it is well to be explicit on fundamentals. Industrial standardization means to single out specific products and materials, to settle upon their properties and dimensions, and to concentrate upon them in production and in use—all to the end of bringing about the greatest overall industrial efficiency. This involves:

(a) Nomenclature

(b) Purchase specifications

(c) Methods of test

(d) Uniformity in dimensions necessary to secure interchangeability of supplies, and the interworking of apparatus and parts.

(e) Provisions for safety

(f) Concentration upon the optimum number of types, sizes and grades of manufactured products

According to the scale upon which it is carried out, the process of industrial standardization may be classified roughly into four stages, namely:

1. By individual firms
2. By societies or associations
3. On a national scale
4. On an international scale

The number of individuals and organizations interested in any particular piece of standardization work increases greatly as it develops from one of these stages to the next. On this account, and for many other reasons, the difficulties increase in a greater ratio from stage to stage than do the number of parties at interest. Likewise, the extent to which standardization may be carried is very much less in scope, in incisiveness, and in elaboration of detail. On the other hand, its importance industrially increases from stage to stage, and when international standardization can actually be carried out it is bound to be far-reaching in its effects.

Generally two or more of these stages develop simultaneously. In fact, all four stages may be developing at the same time. Furthermore, as a practical matter no sharp line of demarkation can be drawn between the four stages. A piece of standardization work which has been carried out by a society or an association may have been put upon so sound a basis that it becomes essentially a national standard. The same is true even of the work of individual companies. Several striking examples of the latter are to be found in the field of mechanical engineering, e.g., in tapers and wire gages.

Standardization by individual firms is now well developed in all the principal industrial countries. It is an essential element in mass production. Unquestionably up to the present it has been pushed farthest in the United States.

Standardization by societies and associations has also been greatly developed in industrial countries. In many cases standards so developed have come into such general use as to make them essentially national in character. In far more numerous cases such standards are receiving increasing recognition, but systematic co-operation and understandings with other interested bodies will be necessary to bring about full national recognition.

National Bodies. The movement for industrial standardization along national lines, although a recent one, is now getting well under way. There are now fourteen national standardizing bodies in all: in Austria, Belgium, Canada, Czecho-Slovakia, France, Germany, Great Britain, Holland, Italy, Japan, Norway, Sweden, Switzerland and the United States. While the British Engineering Standards Association is the only one of these which antedates the World War, and some of them have been only recently organized, the opportunities and need for the work are such that more than half of them have already accomplished work of real significance and importance in the development of their national industries. The work is being woven intimately into the industrial fabric. Of the national bodies the British and the German are the largest and their work is the most extensive at the present writing.

> There are many and serious obstacles in the way of the development of international industrial standardization, such as differences in languages, racial temperament, historical and industrial background, limitations imposed by geographical conditions, the metric and English systems of weights and measures, national animosities and rivalries, exigencies of commercial conditions, ignorance on the part of industrial leaders of the significance of or even of the existence of foreign work, and the instinctive conservatism, not to say suspicion, of a large proportion of men toward new developments and ideas.

Steps in International Work. Naturally much less has yet been accomplished in international industrial standardization than in national work. Yet beginnings

have been made in several fields and in some lines substantial progress has been made. Three formal international bodies have been set up for standardization work. These are in the electrical, illumination, and aircraft fields. The national bodies are in touch with each other and are interchanging information on many projects in process in their respective countries. Through these and other means considerable international uniformity has been brought about in a variety of specific subjects. Examples are mentioned below. Furthermore, a great deal of essential work has been accomplished in securing international uniformity in the use of fundamental units and methods of measurement which are a prerequisite to nearly all phases of industrial standardization.

International Electrotechnical Commission. The oldest and most experienced of the international bodies whose primary purpose is industrial standardization is the International Electrotechnical Commission, which was organized in 1906. The commission itself consists of a national committee in each of the 26 countries represented. These national committees are made up of accredited representatives of the various technical and industrial associations interested in standardization in the electrical industry. Nearly the whole of the work is done through advisory technical committees international in composition. Formal actions are taken at plenary sessions which are held at infrequent intervals. Agreements have been reached and published on a considerable number of electrical subjects, including such matters as definitions, symbols and general rules for acceptance tests. The most important part of the work is that dealing with the rating of electrical machinery and apparatus, that is to say, rules for determining what capacity may be claimed for apparatus and machinery as a basis of sale or tender. The war seriously interfered with the development of the commission's work. The question of a revision of some of the most important parts of the work on rating has recently been raised. The president of the commission is an American, Dr. C. O. Mailloux.

International Commission on Illumination. This commission, which was modeled somewhat after the lines of the International Electrotechnical Commission, was organized in 1913. Its work up to the present time has dealt with fundamental photometric definitions and quantities, hetereochromatic photometry, definitions and symbols, lighting in factories and schools, and automobile headlights. The president of this commission also is an American, Dr. Edward P. Hyde.

International Aircraft Standards Commission. This organization is also modeled somewhat after the International Electrotechnical Commission but the national committees are primarily governmental in character. The commission has developed from the co-operative efforts of the allied governments during the war in aircraft matters. There is no American national committee. At present, the commission is not active except as an agency through which the national committees exchange information on standardization matters relating to aircraft. The principal reason leading to this partial cessation of functions is due to the fact that the exact relation of the commission to the International Air Convention has not been clearly worked out. The Air Convention was an annex to the Versailles Treaty. The commission had under way work on a considerable number of problems. In these, dimensional standardization played a much larger role than has been the case with the International Electrotechnical Commission and the International Commission on Illumination. The work of these two latter bodies, as already indicated, has primarily to do with specifications, methods of tests and nomenclature.

International Chamber of Commerce. Considerable interest in industrial standardization has been taken by the International Chamber of Commerce. It has been decided that the Chamber will, however, not go into the field of technical standardization but will use its prestige and facilities to further the standardization movement and to promote the use of recognized standards and the actual understanding of such work on the part of nationals engaged in international trade.

International Scientific Bodies. By far the most important of the international scientific bodies from the point of view of national standardization is the International Bureau of Weights and Measures. This is a governmental body and through it there has been accomplished a considerable amount of important legislation throughout the world, dealing with fundamental units and concrete standards of weights and measures. Important work on the temperature scale has also been accomplished by it. Specialized standardization work of important scientific fundamentals, such as standards of wave length, geodetic measurements, and the like, have been accomplished by international scientific bodies, such as those known as International Unions, now affiliated with the International Research Council. Probably even more has been accomplished by co-operation between the national standardizing laboratories.

All of the other national standardizing bodies have drawn heavily upon the experience and the methods of the British Engineering Standards Association. The British developed the method of co-operation which has come to be technically known as a "sectional committee." The actual formulation of specifications and other forms of industrial standards and the technical decisions involved are in the hands of such a sectional committee which is made up primarily of accredited representatives of the various bodies concerned with the standard in question. This general method, or some adaptation of it, has been adopted by all of the national standardizing bodies. The American Engineering Standards Committee had the advantage, during the period of organization, of having the counsel and advice of Mr. le Maistre, the Secretary of the British Engineering

> There are important considerations and powerful forces tending toward international standardization, such as the scientific basis which has been laid in the extensive system of physical and chemical units and measurements; the growth of international trade; the increasing use of specifications and other industrial standards in foreign commerce; the increasing interdependence of national industries; the increasing knowledge of international affairs; the greater tendency to study foreign industrial developments; and the fact that industrial leaders are taking a larger and larger perspective in planning for the future.

Standards Association. Mr. le Maistre was in America twice during this period, the last time being upon the specific request from the Americans for such assistance.

Conference of Secretaries. In April, 1921, there was held in London a conference of Secretaries of national standardizing bodies. While this conference was wholly unofficial in character, it was the most important single step yet taken to bring about international co-operation in the broad field of industrial standardization. In addition to an extremely valuable interchange of experience, the conference resulted in an arrangement for the systematic interchange of information on the status of the various projects which each body has under way. This information is sent every three months to each of the bodies. The information is arranged uniformly and is written on uniform blanks, all by agreement between the offices of the various bodies.

This systematic interchange of information is limited to the indication, by means of numbers, of the stage of development which each project has reached. Minutes of meetings and drafts of standards are not included. The interchange of such information is subject to separate decision in each case, according to the policy of each national industry concerned. All approved standards are interchanged as a matter of routine. Another forward step was a reciprocal arrangement by which each body acts as a sales agent for the approved standards of the other bodies. Thus the standards of each country are always readily available to each of the others, not only to the working technical committees, but to industries of each country generally. The advantages of this co-operation are evident.

> It seems to me that the problems now confronting much of the national standardization movements are much the same as those that surrounded the movements toward trade associations in this country a few years ago, while international standardization will follow in much the same way, but without going so far or so rapidly.
>
> Whatever the ultimate outcome may be it seems to me that the next step in any case is the same—to develop as full and as free an interchange of information as conditions will permit.

It was the view of the Conference that international co-operation in industrial standardization work should proceed along such informal lines, being based primarily upon the interchange of information on active subjects of mutual interest rather than by any attempt at the present time to form a general international standardizing body; that in cases in which formal organization should be found necessary, the organization should preferably be by subject or industry, somewhat along the lines of the International Electrotechnical Commission; but that in all cases efforts should first be made to secure results by less formal methods; and to this end it would often be desirable that, in a given subject, the office of one of the national bodies most interested should, by informal agreement, perform such secretarial functions as would further international agreement in the particular subject.

This would result in some one of the following degrees of organization:

(a) Mere interchange of information and proposals by general correspondence.

(b) Informal subject centers, the office of one of the National bodies most interested performing, by informal agreement, such functions of a secretariat as may further international agreement in the particular subject.

(c) One or more conferences, without a permanent organization, where (b) should be found to be insufficient.

(d) A permanent international body.

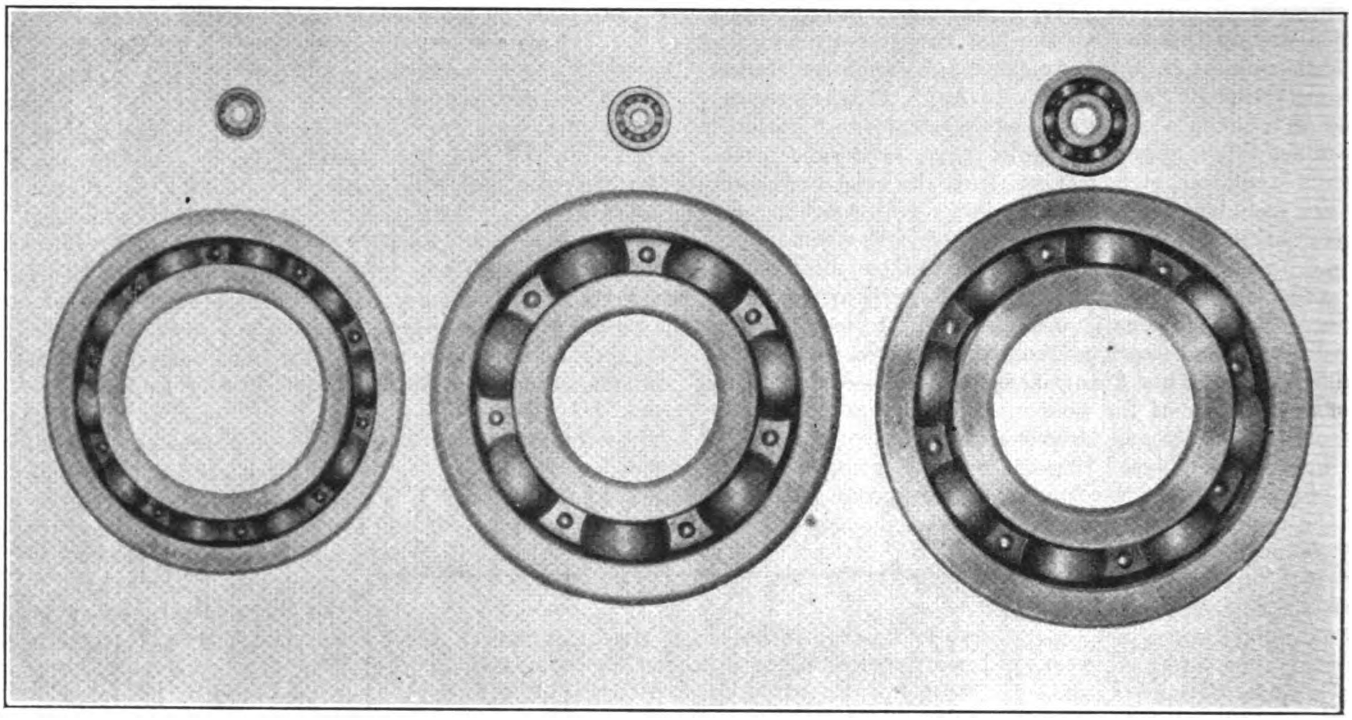
Generally speaking, standardization work in any given industry is apt to be taken up earliest in those countries to which the particular industry is of most importance. In this connection the interesting suggestion has been made by Dr. E. Adler that in bringing about standardization internationally, different countries might be formally recognized as leaders for specific pieces of work with which they are most concerned. While each would bear a special responsibility for those problems for which it would be serving as leader, it would have the co-operation of the other countries concerned thus making the arrangement somewhat like the sponsorship plan of the American Engineering Standards Committee.

It often happens that the same standard is used in two or three, or more, countries, without attaining such use in other industrial countries. This naturally results from commercial interchange, geographical position, the use of metric or English weights and measures linguistic, and other conditions. For example, the commercial and other relations between Belgium and France, Great Britain and her colonies, Germany and her neighbors, Austria, Switzerland, Holland and Sweden, and Canada and the United States have led to such results. The secretaries of the national bodies of Austria, Holland and Switzerland regularly attend group meetings of the German sectional committees.

In addition to the specific examples of international standardization work of the international bodies, which have already been referred to, mention should be made of some examples of projects on which co-operation between national bodies is now going forward.

Ball Bearings. Prior to the war a large measure of international uniformity in the subject of ball bearings had come about, without any formal organization but merely through ordinary commercial and engineering interchange. Of those forms of bearings which are more important industrially, at least 90 per cent are made to dimensions that are standard internationally. This refers mainly to width and inside and outside diameters of bearings, which provide interchangeability. The countries primarily concerned, and in the order of production, are: United States, Germany, Sweden and Great Britain. There has been a considerable interchange of information and suggestions and recently definite proposals were put forward by the American sectional committee, which is working under the joint sponsorship of the Society of Automotive Engineers and the American Society of Mechanical Engineers.

The most extensively used type of ball bearing is undoubtedly the radial bearing, the main purpose of which is to carry radial load. This bearing is built in three series, light, medium and heavy, the selection of series being dependent upon the load which the bearing of a



(Courtesy of S K F Industries)

EXAMPLES OF INTERNATIONAL UNIFORMITY

Six of fifty-nine ball bearings which are interchangeable internationally—the largest and smallest in the heavy, medium, and light series.

certain inside diameter has to carry. The illustration shows the three largest sizes of the above series, which are internationally standardized. The inside diameters are 110 m/m for the light series, 100 m/m for the medium series, and 85 m/m for the heavy series. It also shows the smallest bearings of the corresponding series, the inside diameter being 10 m/m for the light series, 10 m/m for the medium series, and 17 m/m for the heavy series.

The total number of internationally standardized sizes of these three series is 59, which covers practically all the commercial sizes of bearings which are in common use. Efforts are being made to agree on international standards for the extension of these series up to about 300 m/m bore, as well as for thrust bearings and the probabilities are that international standards will be set for all commercially used anti-friction bearings.

Gaging. Everywhere there seems to be a keen interest in national systems of limit gaging, doubtless due in large part to experience during the war in mass production of munitions, in which interchangeability of parts and supplies made by different manufacturers was a necessity. In this the continental work is more advanced than is the British and American work, which has not yet reached the stage of final formal adoption, the decisions being yet in the tentative stage.

On one important point, whether the shaft or the hole shall be the fundamental basis of reference, the American, British, Dutch, German, Swedish and Swiss work is in agreement. The decision is that the hole or, in the case of screw threads, the nut shall be the fundamental basis. The published Austrian standards appear to place the two methods upon an equal basis.

Among these, the continental countries and the American sectional committee (under the sponsorship of the American Society of Mechanical Engineers) have decided upon 20 deg. C. (68 deg. F.) as the standard temperature of reference. The British and Canadians use 62 deg. F. (16.7 deg. C.).

One of the most discussed questions is that of allowances and tolerances, and particularly whether the tolerance shall be stated as a plus or minus quantity or as a plus or a minus quantity. As a simple example consider a hole and shaft for each of which there is to be a tolerance of 0.002 in. to provide for variations in manufacture. Shall the hole be dimensioned at 1.001 in., $\pm$ 0.001 in. and the shaft as 0.999 in. $\pm$ 0.001 in., or shall the hole be dimensioned as 1.000 in. + 0.002 in. and the shaft as 1.000 in. — 0.002 in.? The first is often referred to as the "bi-lateral system," and the latter as the "unilateral system." The continental bodies have definitely, and the American sectional committee has tentatively, adopted the unilateral system. In Great Britain a very spirited discussion on the relative merits of the two systems has been going on for some time but I am not informed of any definite decision yet taken. It is interesting to note that the American sectional committee was organized as a result of a request for co-operation from the British.

Wrench Openings. Provisional agreement has been reached, informally, between most of the continental countries on the widths across flats on nuts and boltheads. The Swiss, who are serving informally as a secretariat according to the general scheme of co-operation sketched above, have made definite proposals for international agreement on a series of dimensions for wrench openings. The proposals include tolerances which are formulated with the intention of making it possible to bridge difficulties arising over the metric-inch question by making the tolerances such as to cover in practice the differences between metric and inch sizes. There are circumstances which make the time favorable for the consideration of the Swiss proposals. The Belgians are revising their work on bolts, and the British have organized work on the same subject and will revise their specifications for spanners. It is not unlikely that the British may reduce their nut and bolthead sizes, which are larger than those in other countries, in order

to make them more adaptable to the up-setting process of fabrication. The American work, which was organized as a result of the Swiss proposals, is just getting well under way.

Screw Threads. Work on screw threads has been active in recent years both in Europe and America. Few, if any, standardizing projects are as far reaching or as difficult. Changes of any kind are very hard to carry out even in the practice of an individual firm, to say nothing of the difficulties when considered internationally.

Whitworth threads are used very extensively in continental Europe, side by side with metric threads and on the whole more extensively. While I do not have authoritative information from all of the countries, I understand that at least the following have already adopted or are practically certain to adopt three series of threads for all but very specialized uses, namely: Austria, France, Germany, Holland, Italy, Sweden, and Switzerland. The three series are the International Metric thread, the Metric Fine thread and the Whitworth. Some of the countries have already definitely decided to abandon several less used metric series. It appears that in these countries the metric threads will be considered the primary standard and the inch threads as secondary, even though the inch threads are now in greater use. It has often been suggested that it is very desirable that the English-speaking countries list the International Metric and the Metric Fine threads as auxiliary standards, in order that, in those cases in which metric threads are used, the practice of the metric countries should be followed.

Agree on Thread

In this country the National Screw Thread Commission and the American sectional committee (the American Society of Mechanical Engineers and the Society of Automotive Engineers, sponsors) have now reached tentative agreement on the various details for the coarse and fine series of the American form of thread. The results have been transmitted to the British and Canadian associations. Whether some form of unification of the Whitworth and the American coarse series (practically the "U. S. Standard") should be carried out has often been discussed. Latterly, the opinion has frequently been expressed that discussions should not center, as formerly, upon the form of thread, since in the coarse fits the actual forms depart widely from the theoretical form. The pitches of the two series are identical with exception of the half-inch size, for which the Whitworth has twelve threads and the American thirteen per inch. Should the suggestion prove correct that the differences in form of thread may be ignored for loose fits and for all rougher work, a great part of the difficult problem would still remain unsolved. If the two series are to be unified, a great amount of study must be given to the questions, (a) What basis or bases of unification are possible and feasible? (b) Would the industrial advantages of unifying the two systems outweigh the cost and trouble of its achevement? In my opinion, far more extensive and explicit information than is now available will be necessary for the correct solution of these questions.

Information the Basis of Co-operation

Specifications for Zinc. The national bodies in countries concerned with the production of zinc and zinc ores are studying proposals put forward by the Belgians for international agreement on specifications for zinc and zinc ores. These are intended to clarify certain technical matters which affect the international market and about which misunderstandings arise. The American sectional committee was organized as a result of the Belgian request for co-operation.

From the very nature of industrial standardization it should be evident that there must be a full, mutual understanding and appreciation of the problems and point of view of the various parties at interest. This is true regardless of the scale upon which standardization in any particular project is carried out, whether by firms, by associations, nationally, or internationally. In any case there must be an interchange of information, the freer the interchange the better. It should occur as early as possible in the development of the work, in order that the necessary mutual understanding may be brought about. It is not enough to interchange information on completed work. Each country wants to have its standards become international standards.

Must Enlarge Views

If all the different countries wait until their work is completed before submitting it to the others, any one of them, by proposing its own standard for international adoption, places the others in the position of being asked to sign on the dotted line. Human nature is such that this does not work well. If information be exchanged during the development of the work, opportunity is given for each to understand and appreciate the other's point of view, and each is much less apt to become committed to policies and provisions which it would have been willing or even glad to have had different, had it had the advantage of such information during the development of its own work. Thus are agreements made easier and technical and industrial progress facilitated by the mere interchange of information.

For these reasons, the secretaries of the national standardizing bodies made the question of the interchange of information the principal consideration in their conference in London, as has already been indicated. I believe that the simple, systematic interchange of information on the status of projects there initiated will prove to have been a milestone in the industrial standardization movement, from the national as well as from the international point of view.

Publications of Value

Another very important development is the special publications, in journal form, of the national bodies in Austria, Germany, Italy and Sweden. In these, drafts of proposed standards, abstracts of minutes, etc., are given in much fuller form than such information is made generally available in Anglo-Saxon countries. The Germans consider that their "Mitteilungen" has been one of the prime factors in the extremely rapid development of their work. The information in these publications, while intended for their own industries, is, of course, available in other countries.

An A.E.S.C. European Representative. It has been suggested that the American Engineering Standards Committee could perform an extraordinarily important service to American industries by maintaining a representative in Europe. An engineer having the right combination of temperament, experience and linguistic ability would be able to supply an amount of information to our working committees on the standardization work going on in Europe and furnish a knowledge of

the industrial background upon which the standardization work is based that is quite impossible without direct personal contact. On the other hand, he could perform a like service in giving to the European bodies the American viewpoint and background. The benefits to American industries of the work of such a representative would be out of all proportion to the cost. Even the byproduct services which he would render should far exceed the entire cost.

In this connection it is instructive to note that Germany and Japan are the only two countries that have adopted a policy of studying technical and industrial progress in other countries systematically and intensively. There is no doubt that this policy has contributed in an important way to the meteoric development of the industries of Germany and of Japan.

What of the Future?

There are many and serious obstacles in the way of the development of international industrial standardization, such as differences in language, racial temperament, historical and industrial background, limitations imposed by geographical conditions, the metric and English systems of weights and measures, national animosities and rivalries, exigencies of commercial conditions, ignorance on the part of industrial leaders of the significance or even of the existence of foreign work, and the instinctive conservatism, not to say suspicion, of a large proportion of men toward new developments and ideas.

On the other hand, there are important considerations and powerful forces tending toward international standardization, such as the scientific basis which has been laid in the extensive system of physical and chemical units and measurements, much as an alphabet forms a basis for written language; the growth of international trade; the increasing use of specifications and other industrial standards in foreign commerce; the increasing interdependence of national industries upon each other; the increasing general interest in and knowledge of international affairs; the greater tendency to study foreign industrial developments and to adopt those which are applicable to home industries; the circumstance that specific industries are developing more and more along the same lines in different countries; and the fact that industrial leaders are taking a larger and larger perspective in planning for the future.

Standardization Near

The actual line of development must necessarily be the resultant of such conflicting tendencies and forces. In my opinion, a very considerable amount of international standardization will take place in the next few decades. This opinion is based largely upon evolutionary considerations. For example, it seems to me that the problems now confronting each of the national standardization movements are much the same as those that surrounded the movement toward trade associations in this country a few years ago, while international standardization will follow in much the same way but without going so far or so rapidly.

Whatever the ultimate outcome may be, and whatever one's estimate of the success of the movement toward international standardization may be, it seems to me the next step is in any case the same—to develop as full and as free an interchange of information as conditions will permit. Through some such procedure can standardization best be firmly established.

Experimental Production of Alloy Steels

By H. W. Gillet and E. L. Mack

Bulletin No. 199, of the Bureau of Mines, Department of the Interior, gives some of the results of the experimental heats of alloy steels recently made by the bureau for the Army and the Navy. The steels for the Army were desired for work on gun erosion, especially in regard to the effect of nitrogen on steel.

The use of a small direct-arc electric furnace for making small experimental heats of alloy steel is attended with difficulty in the control of the carbon content. Indirect-arc types, however, such as the Stassano, Rennerfelt, or the simple homemade furnace described allow a much better control of the carbon content. The raw material used must be sufficiently low in sulphur and phosphorus to obviate the making of refining slags, and straight melting, analogous to the crucible-steel practice, must be done. With these provisions, the making of special alloy steels in 50- to 100-lb. heats, to chemical specification, is relatively simple in a 50-kw. indirect-arc furnace.

Results Not Promising

This report deals only with the preparation of the various steels and with the recovery and the segregation of the different alloying elements. Some of the steels whose preparations are discussed in this section were of rather unusual composition, and many were nickel steels high in silicon, or steels higher in the various alloying elements than the common steel compositions.

As the composition of many of the steels is suitable only for special uses, no direct general conclusions can be drawn as to the value or lack of value of zirconium, titanium, uranium, boron and cerium as true alloying elements in the commonly used types of steels. In various physical tests of the steels covered by this report, steels in which these elements are present in appreciable percentages, the results so far obtained have not in general been promising. Nor have they been as good as those of similar steels of the series without these elements. Recent reports of tests of plain carbon steels of low carbon content to which less than 0.25 per cent of zirconium has been added are said to indicate that zirconium may have a beneficial effect, especially on notched-bar impact tests.

Used in Degasifying "Wild" Steel

Although these elements are readily oxidized, none of them appear to be as efficient as aluminum or vanadium in degasifying "wild" steel. No special study has been made of very small amounts of these elements used as scavengers only, but all of them seem likely to leave their oxides or other compounds trapped in the steel as inclusions when they are added immediately before pouring, as is necessary in order to get a good recovery when using them as alloying elements rather than as scavengers.

Boron is almost quantitatively recovered when added at the end of the heat and may be added at the start of the heat without great loss. In the amounts studied up to 0.6 per cent, no appreciable tendency to segregation was noted.

A complete copy of the paper may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of fifteen cents.

Methods of Machine Tool Design

Continuation of the Section on Feed Mechanisms—Various Cam Arrangements for Screw Machines—The "Program" Machine and Its Future Possibilities

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

THE problem of keeping the size of a cam down to the lowest possible dimensions is a very important one, not only because large cams increase the size of the machine, and are apt to make it unsightly, but because they are also apt to decrease the strength and rigidity of the frame. The means employed to minimize the size of the cams are the following: Steep slope of the cam; return movements made by springs or weights; some of the functions actuated by springs or weights; some of the functions actuated by cams which revolve only when required and which revolve at a high speed, while the main cam may revolve at a lower speed.

The first method, that of using steep slopes for the cam, is very limited in its application. A steep slope is not advisable during feeding operations, although some instances have come to the writer's attention where a feed cam was used with an angle of 65 degrees. Of course, such an arrangement sets up excessive side strains, is very wasteful of power, and causes an uneven action on the tool. As a rule, cam slopes are held down to 45 deg. or less, even for return cams, whereas it is good policy to limit the slope of feed cams to 1 in 3. Attention should be called to the fact that not much can be gained in smooth action of the cam by making the slope less than 1 in 3. The smaller the angle of slope becomes, the less can be gained by making it still smaller.

USE OF SPRINGS OR WEIGHTS

The second method of using springs or weights for return movements is safe when light members must be returned and when there is practically no danger of anything sticking. Where there is any danger at all that a tool may stick in the work or a slide may stick on its bearing, on account of the gumming up by cutting compounds or choking up by chips, this method is not safe.

The third method applies to such functions as feeding the stock in an automatic screw machine or doing any of the "productive" operations of some other automatic machines which call for a definite and limited amount of power only. A spring or weight can be applied in such cases.

The fourth method is the one referred to before and used in such machines as the Brown & Sharpe automatic screw machine where the shifting of belts, opening and closing of chucks and stock feed, are all accomplished by a cam which is clutch-operated and which makes a full or half revolution at a rapid rate after which it stops until it is tripped again. While such a cam is operating, the main cams of the machine keep on revolving at their relatively slow rate.

The peculiar construction of certain machines lend themselves to still other methods. An interesting way of reducing the size of some of the cams is employed in the Cleveland screw machine. In this machine two cams are used for the feed motion, one for the turret and another one for the cross-slides. The turret cam makes a full revolution for each movement of the turret. If there are five tool positions in the turret, then this cam will make the turret go forward and backward five times during the complete cycle. This cam causes the same stroke, whatever tool is used and whether the active stroke is long or short. Controlling mechanism at some other part of the machine causes this cam to revolve either fast or slow.

VARIATION OF SPEED

The actual feed stroke can be made as long or short as may be desired. If, for instance, there is a total stroke of 6 in., it will be possible to run the cam slowly for this entire 6 in. and return it fast to its starting position. Or the cam may advance fast for 4 in., then slow for 2 in., and then return fast the entire 6 in., or any other method of dividing up the total 6 in. Then, again, it would be possible to advance rapidly for 4 in. (or any other amount less than 6 in.), then feed slow for 2 in., and keep this slow movement for part of the return—let us say 1 in., after which it returns fast the remaining 5 in.

Not only is it possible to make any part of the forward or backward stroke fast or slow, but the slow movement can be given different rates of speed by a feed-changing device, so that on one stroke we may have a feed of 0.006 in. per revolution of the spindle and on another stroke—that is, for another tool—we may have a feed of 0.020 in. per revolution of the spindle. There is on this same machine, as was said before, a second cam which operates the cross-slide. This cam makes one revolution for a complete cycle of the machine, that is, the latter cam makes one revolution while the other cam makes five (supposing there are five holes in the turret).

DIVIDING FUNCTIONS AMONG SEVERAL CAMS

The cross-slide cam also has the fast and slow motion and it should be noted that both cams are running fast or slow at the same time because they are driven by the same mechanism. The cross-slide cam is not fixed but can be changed. Cam straps can be taken off and other straps put on to suit the requirements. It may very well be that the cross-slide cam requires a long movement or stroke at the same time the corresponding turret tool should get along with a short stroke. In that case, it is necessary to continue this slow movement, though the turret cam might have had a fast movement. This arrangement makes it possible to utilize a relatively small cam for the turret, but it does not obviate the necessity of using a large cam in the machine.

When the stroke required for various operations is long, the cam assumes very large proportions and that regardless of whether the stroke is used for feeding the tools or for any other purpose. It is therefore desirable to have some other method by which cams can be held down in size. If there were a cam for each operation and if this cam should be turning only when that particular operation takes place, it would be possible to keep these cams down to a very limited size.

For the author's forthcoming book.

If it were found that some of the operations are short, then these operations might be combined in one single cam. Referring to the schedule of the screw machine with four tools which was discussed in a previous paragraph, we would do operations *a*, *b*, and *c* with one cam. After performing these operations the cam would stop, so that no space would be required for *d* (dwell of first tool and cross-slide tool). Another cam would then be set in operation for *d-1*, *d-2* and *d-3* (indexing and locking of turret), after which this cam would stop. A third cam would be used for *e*, *f* and *g*, whereas the second cam would be set in motion once more for *h-1*, *h-2* and *h-3*. A fourth cam would then perform operations *i*, *j* and *k*; after which the second cam would take care of *l-1*, *l-2* and *l-3*, and so on.

Distributing Operations over Several Cams

This leads to a great many cams and may be objectionable for that reason. If the feed motions do not require a long stroke, it would be perfectly feasible to have all the cam straps for *a*, *b* and *c*—*e*, *f*, and *g*—*i*, *j*, and *k*—*m*, *n*, and *o*, all on one drum, while the straps for *p*, *q* and *r*—and *t-1*, *t-2*, *t-3* and *t-4* could be on another drum. There would then be altogether three cams, one for the turret advance and feed motions, one for belt shifting, chuck opening and closing and stock feed, and one for turret indexing. In addition, there would be a similar cam for the cross-slide feed motions. All of these cams would be of relatively small size.

The difficulty we encounter with such an arrangement is this: that we must take good care that each cam operates at the proper moment and that there is no accumulation of error. There must be some controlling mechanism which will start and stop each cam at the proper moment and which will prevent them from getting out of time.

Such a controlling mechanism might be a disk which revolves once for a complete cycle of operations. Dogs mounted on this disk would operate clutches which would engage or disengage the various cams. Such a control mechanism would insure that each cam operates at the proper moment, but it would not insure the proper timing. To illustrate this, let us assume that there are two cams for different operations. We will call these cams *A* and *B* and assume that they are thrown into action by a positive clutch. When cam *A* has made one revolution (or as much of a revolution as may be necessary for a single stroke), the control mechanism throws out the clutch for this cam and, at the same time, throws in a clutch for cam *B*.

Controlling the Individual Cams

It may happen that the teeth of this clutch strike so that a part of a revolution of the clutch passes before cam *B* is engaged. To visualize the thing still better, let us assume that each of the two cams *A* and *B* occupies one-half of the total cycle and therefore one-half of the control disk. The striking of the clutch teeth has wasted, let us say, one degree of this movement, so that cam *B* will revolve through 179 deg. when the dog on the control disk throws it out of action. On the next cycle there may be a similar striking of the clutch teeth, again robbing cam *B* of one degree of its movement. It will be seen that whatever error there is in the engagement of the clutches is accumulated, so that in the course of time the cams must be in the wrong relation to one another. This method of control, then, which depends on a full cycle of the machine, cannot be used with this system.

To make such a system operative cam *A* should throw itself out after it has turned through the proper angle or the proper number of revolutions and it should throw in cam *B*. Cam *B*, in its turn, after making its proper number of revolutions, should throw itself out and throw cam *A* into action.

No Possibility of Accumulation of Errors

To show that such an arrangement would keep all functions in time, we will assume again the same conditions as before and see whether there is a possibility of an accumulation of error. Cam *A* completes a revolution, which corresponds to half the cycle, and throws its cam out which, of course, is a positive action happening at the exact place where the dog is set. It also throws into action cam *B* by means of a clutch. This clutch may fail to engage for a moment because the teeth strike. As a result there will be a period of idleness between the end of the action of cam *A* and the beginning of the action of cam *B*. But finally cam *B* will start its functioning, make a complete revolution, throw itself out, and start cam *A*. Whatever the delay may be in the throwing in of the clutches, such delay does not have any effect on the functioning of the two cams.

Combining Other Mechanisms With Cams

Some of the functions of an automatic machine may not be controlled by cams but by some other kind of mechanism. For instance, the indexing of a turret or other member may be effected by a Geneva motion which is revolved through one-fourth, or one-third, or any other fraction of a revolution. With the ordinary arrangement of cams, an idle space must be provided on all of these cams during the time that such operation takes place. If the operation was started by the throwing in of a clutch, the idle space on the cam must be made long enough so that any delay in the engagement of the clutches will not cause one of the cams to start its action before the proper time, for instance, after the indexing is completed. We see, then, that whether machine functions are controlled by cams, or by any other kind of mechanism, those cams which are actually used must be of a size sufficient for all the time occupied by such other mechanisms.

However, the final size of the cam may be made less by having some of the functions of the machine operated by a different kind of mechanism. If, in the previous example, the indexing was done by means of a part of the cam, then, in order to save time, it would be necessary to run the cam at high speed during that period and, as a consequence, a large portion of the circumference of the cam would be occupied for the period of indexing. If, on the other hand, the indexing was controlled by, say, a Geneva motion, we could throw this into action by a clutch on a shaft running at fairly high speed, meanwhile running the cam at a low speed so that, during the short time required for the indexing, only a very small part of the main cam would have passed a given point. Arranging things this way, however, is not always safe. Should the clutch refuse to engage for a considerable length of time, the index might take place after the cam has started some other function of the machine and this might lead to serious trouble. In short, then, if we wish to operate various functions of the machine by cams and other mechanisms not positively connected, we should arrange matters so that each previous element throws itself out at the end of its functioning, at the

same time throwing the next element into action. This system lends itself very well to highly complicated machines, has the advantage of using small cams, and simplifies the setting up and the analysis preparatory to the changing of a job.

Taking, again, the example of the automatic screw machine with four turret positions, we might make one cam for all the advances, feeds, and returns of the turret. We could do this in two ways: either make the cam sufficient for a single stroke only, or else make it so that one-fourth of the cam is used per stroke.

Applying Separate Cams to a Screw Machine

In the first case, we would have an arrangement resembling very much the turret feed cam of the Cleveland screw machine, but in this example the cross-slide cams might also be made small. It would be possible here to have a long cross-slide operation combined with a short turret movement. We may assume that the turret cam has started and after the turret is on its way a dog on this turret cam throws the cross-slide cam into operation. This cross-slide cam may go as fast or slow as may be required. It will keep on running for a complete revolution when it will throw itself out.

In other words, after it has once started it has no further relation with the turret cam. At the end of the stroke of the turret cam—that is, after this cam has made one full revolution—the index mechanism is thrown in, and at its completion the turret cam is thrown in, this time by the indexing mechanism. This will be repeated three times, but at the end of the fourth time, the index mechanism does not throw into action the turret cam but some other cam used for opening and closing the chuck and feeding the stock.

All that would be necessary to accomplish this would be to have a disk upon which dogs are mounted and which makes one full turn for four index movements. The first three dogs would have acted directly on the turret cam mechanism, whereas the fourth dog acts on the stock feed cam. When this latter cam has made one full revolution, it throws itself out and may throw into action the turret cam, this starting again a complete cycle.

The Other Arrangement of Cams

If our machine had been a chucking machine instead of a screw machine, the stock feed cam would have been omitted and the fourth dog on the index mechanism would have thrown this mechanism out of action without starting the turret cam, thus stopping the machine. If such a chucking machine were provided with a collet chuck or any other kind of chuck which can be operated by a single movement, we might have had a cam for this operation and we would start the cycle by starting that cam. It will be seen that this arrangement of successive cam operations is much more elastic than the common arrangement by which the time of all the various operations is laid out on the circumference of one single cam.

If the second scheme had been followed—that is, if we had put the feed cam for the four turret positions on one drum—we would have had the following sequence of trips. The first part of the feed cam advances and returns the turret and then throws itself out of action and starts the index. The index having been completed, its mechanism throws itself out and starts the feed cam again, which makes another quarter turn, repeating the operation until, at the end of the fourth indexing operation, the machine either stops itself or the index mechanism acts upon a cam for chucking, etc. The four parts of the feed cam may be equal or unequal. If equal, the dogs for tripping the index mechanism may be stationary. If not equal, they must be adjustable so as to place them always in the proper relation to the end of the cam groove. The manner in which the index mechanism may cause a tripping of the feed cam for the first three movements and of some other cam at the end of the fourth movement may be accomplished by having a disk on which dogs are mounted and which turns once during the four complete operations of the indexing mechanism. The fourth dog would be different from the other three and would operate in a different plane.

A Glimpse of the Future of Automatic Machines

It is, perhaps, not out of place here to enlarge somewhat on the possibilities of such a system of control of automatic functions of machine elements; to look into the future, so to speak, and describe a style of machine which is not yet in existence but which would have certain definite advantages and lend itself to automatic machining operations on pieces which are not made in sufficiently large quantities to justify the setting up and camming of the present style of automatic machines.

I would call this style a "program machine." Such a machine might have a turret with tools, cross-slides. milling attachments, drilling spindles, or any other kind of tool or work carrying elements. The functioning of the machine might include the chucking of stock, the operation of magazines, the feeding of bar stock, the shifting of belts or gears, the throwing in of clutches, the indexing of a turret, the starting of a stream of lubricant—in short, any operation which is now done by any of the existing automatic machines.

Each element to be moved would have its mechanism which goes through a predetermined cycle and then stops itself. Such a mechanism might be a cam or an indexing mechanism, or a one-revolution clutch, or it might even be a screw which makes a certain number of turns forward and then reverses; but all of them would have this much in common: that they would go through a certain cycle of operations and then throw themselves out of action. The differences between such a system and the system of camming described in the previous paragraphs would be this, that in this system an element throws itself out at the end of its cycle but does not throw into action any other element. This throwing into action might be done either by hand or by another mechanism which may or may not be supplied with such a machine.

The "Program" Mechanism

In case the elements must be started by hand, the auxiliary mechanism, which we will call the "program," might consist of an endless chain which is advanced one link every time a cycle comes to an end. The movement of this chain would bring a letter or set of instructions before the operator, bringing it under a window so as to make it visible. There would be a number of starting levers or buttons or knobs which take the place of such elements as are ordinarily acted upon by the dogs of an automatic machine. These levers or knobs would be plainly marked with a letter. At the end of a cycle, then, we will say that the letter *D* appears, which tells the operator that he must move the lever or knob marked with that letter *D*. At the end of the next cycle the letter *A* appears. At the end of this cycle the letter *C*, etc. The chain would have as many links as there are

operations to be performed. With a four-hole turret, of which all holes are provided with tools, the letter *A* would appear four times (if *A* stands for starting the turret), and the letter *C* also four times (if *C* stands for starting the index). If, on the other hand, this four-hole turret were provided with two tools only (that is to say, if two holes were idle), we would get the following: *A, C, A, C, C, C,* and then *A* again. Instead of having single letters appear, it might be possible to have written instructions appear, telling the operator not only which letter to start next, but also whether he should measure or do other things which may be required.

Making the Program Machine Automatic

This machine might be provided with a number of small pneumatic cylinders and the links of the chain might be provided with pins which would operate the valves for these cylinders. Such an arrangement would make the machine entirely automatic. By leaving the pin out of the last link of the chain, the machine could be made to stop at the end of the completed cycle. Almost endless variations to this arrangement could be devised. Instead of a chain, a perforated roll of paper might be used, very much like the music rolls for a player piano. The author, in the June, 1920, issue of *Industrial Management,* expressed his belief that such a style of machine is needed and will ultimately be brought out.

The exact form which such a machine would take cannot be predicted. It would replace a group of machines. It would have the advantage over such a group that a mere change of the letters or instructions on the chain would have the same effect as a complete regrouping of the machine. Suppose there were a group of six simple machines, of which three can be operated by one man. The next job might need only five of these six machines and would require an entirely different grouping. It is, of course, out of the question to change machines around for every job, so that, with a number of machines grouped in a permanent way, we will have almost always an unsatisfactory arrangement; perhaps one or two idle machines and loss of time in many other ways. The program machine would overcome these disadvantages completely.

This Lily Needs No Painting

By Charles W. Lee

There are few lines of industry in which greater care is required than in the manufacture of machinery. There is no easy, hurry-up path to success and the buyer will always be found critical of any product for which he pays his good money. The following episode, which is founded on fact, will illustrate this point as well as any which has ever come to our notice.

A certain maker of machinery, who holds the mistaken opinion that the way to succeed in the machinery business is to "get 'em done, get 'em out and get the money for 'em," was sent thè following letter which speaks for itself:

"Your machines were duly received and dismantled for inspection. But we find it impossible to re-assemble them in proper alignment because we can find no newspapers in our city that are of the same thickness as your local newspaper. Please send us three or four copies of the latter."

Machine Shop Bulls—I

By Joe V. Romig

To make a bull means, in the parlance of the machine shop, to spoil a job, and this sad and awful experience comes to every machinist occasionally, and to some more often.

A familiar saying of the machine shop is, "The guy that never spoils a job, never makes any right." Although this saying does not offer an excuse for a bull, it contains a bit of truth, nevertheless.

One of two things usually happens when a bull is made. Either it is covered up or repaired, or it is found out with the resulting dismissal of the bull maker or his being retained with a reprimand. It depends pretty much on the foreman.

Once, two hoboes, brothers, so they said they were, applied to the shop foreman for positions as machinists. They had rolled into the mill's railroad siding on a coal train and they surely looked like two regular hard boiled guys. Machinists were scarce at the time, and they were taken on.

Sam was shunted to the outside repair gang, while Tom was put to work on a small lathe in the machine shop. Tom's first job was a small eccentric, a repair job for one of the mill's small hoisting engines. A drawing was given him by the foreman, showing plainly all the dimensions, and specifically calling for the bore to be ½ in. off center.

The Literal Word

When he finished the job he took it to the boss and asked what was next on his program sheet. One look at the roughly finished job was enough for "Reds," our foreman, as he saw the centrally bored eccentric hole.

"Ye gods, man!" he shrieked, "How much throw did you give this job?"

"Throw, what do you mean?" replied Tom, the hobo machinist.

"You're fired, get out of my sight!" screamed old "Reds," as he turned away in disgust.

In the meantime, Sam was also having his own troubles. His instructions had been to tear out a section of leaky water pipe, and he followed them literally, not taking the time to shut off the source of water.

Although the pipe leaked badly while he was sawing out the section, he kept on until the section blew out and drenched him in the outflow, much to the amusement of the rest of the gang.

The brothers met together at the pay clerk's window, after which they left by the same route in which they had come, namely *a la* bumper.

"Quid Pro Quo"

By R. Grimshaw

This proverbial expression, signifying "something for an equivalent" should apply in all business relations, for no transaction will be permanently profitable unless satisfactory to both parties concerned. In particular application to industry it means "a fair day's work for a fair day's pay" neither element being considered more important than the other, and neither side to the bargain or transaction to make mental reservations or to break contract in letter or in spirit. The foreman can see to it that this motto is enforced as against both management and workers.

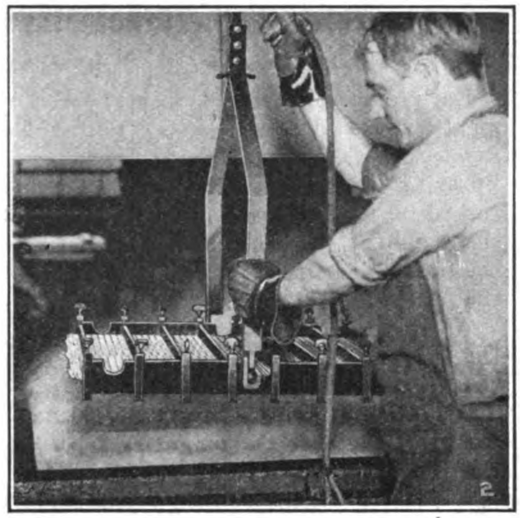


FIG. 1—ASSEMBLING THE STRIPS IN FRAME. FIG. 2—SOLDERING THE STRIPS TOGETHER

Forming the Franklin Grille

MOST PEOPLE like to have things that appear conventional rather than otherwise, even to their automobiles. So, in order to resemble the effect of the honeycomb radiator, the Franklin engineers designed a grille for the front of the hood which appears conventional and yet serves its purpose of admitting air freely while protecting the motor as in other cars.

This grille is made up from sinuous strips of sheet metal, formed by passing them between corrugating rolls. The strips are then laid in rows between points in a suitable frame as shown in Fig. 1 with the points so spaced as to bring the tops of the curves together and leave a series of openings between the strips. When the frame is filled and the strips clamped in place, it passes to the next operation where it is dipped in acid and then into molten solder, as in Fig. 2. The solder unites the strips into a solid grille so that it can then be handled as one piece.

The grille is then taken to a band saw where the outside is trimmed according to a templet clamped to it. This operation is shown in Fig. 3. A round hole is also sawed at *A* where the grille fits over the starting-crank end of the crankshaft. The grille is then mounted in a suitable frame or case in the same way as the core of a radiator in a water-cooled car. It has no need for water connections, however, and so is much simpler and lighter than the regular radiator.

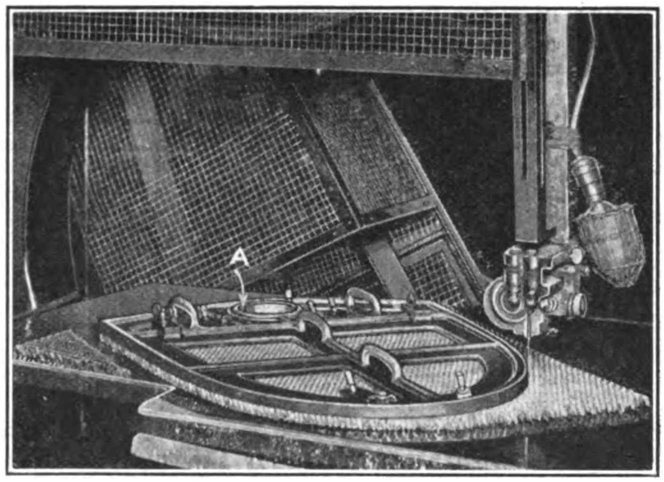


FIG. 3—SAWING THE GRILLE TO SHAPE

The Disease Called Drafting

By Entropy

Out of every graduating class from every engineering school there is sure to be a small number of young men who do not immediately find the jobs they would like. A very few of these men go back to the school and teach, the rest get jobs as draftsmen. They make themselves think by so doing that they are entering on a state, humble to be sure, of engineering. What they find out, unless they recover their wits soon, is that they have tied one end of a rope around their necks the other end of which is tied to a large and husky mill stone.

There is no very logical reason for this condition. It is simply a fact that managers, as a rule, are not looking toward their drafting rooms for material from which to select executives. Cause and effect work here very much like a dog chasing its tail. The fact that the drafting room is not regarded as the place to find executives makes men who have strong ambitions fight shy of going into them at all. Consequently, the drafting jobs do not attract the best type of men in any considerable numbers. As a result of that the work turned out in drafting rooms is not so well thought out as it should be. It is much criticized, and being criticized is made still less attractive to men who aim to be successful, and consequently the drafting room becomes the graveyard of hopes for both old and young.

This is just mere shortsightedness all along the line, and can be cured by attacking the problem anywhere in the circle it describes. The most natural and easiest place to begin the reform would be for the management to look over its drafting force each time it wanted to make a promotion, and if possible to take enough men from that source to give the rest of the men encouragement to try for higher jobs. Once the circle is broken there will be better men using the drafting room as a stepping stone for promotion, better drawings and better co-operation between engineering and production departments.

Circulating the Trade Magazines

By Dorothy A. Washburn

Each new magazine is sent to the record department, which contains the centralized files for letters, invoices, orders, catalogs, etc., and the library. The librarian in charge receives the magazine and makes a record of it. A card in duplicate is typed, headed by the name of the magazine, and listing the names of the persons to whom it is to be sent, with a column for the date, similar to Fig. 1.

At the head of the column is written the date of the magazine and after each name is written the date that person is to return it to the record department. The cards are then filed in two separate divisions. One file gives the date the magazine is to be returned, and the other the reader to whom it is sent.

A printed form similar to Fig. 2 is pasted on the front of the magazine. In the date column is stamped the date the magazine is to be returned, and it is then sent on its way.

As a rule the length of time allowed to read each copy is about three days. If anyone wishes the copy again, and requests its return, it is sent back for a longer period after others have read it.

The person receiving the magazine knows he is to return it by the date stamped. He signs his name in the column headed "Name" on the slip, so that when

AMERICAN MACHINIST				
	Nov. 10		Nov. 10	
J. Jones	11/14	M. Close		
J. White		W. Lewis		
G. Brown		H. Hughes		
D. Smith				
L. Wood				
M. Douglas				
R. Post				
K. Clark				

FIG. 1. MAGAZINE RECORD CARD

a magazine is returned to the record department the librarian knows that the person for whom the magazine was intended, actually received it.

After the cards (Fig. 1) are made out and the slips pasted on the magazine, the file to subscribers is glanced through, and it can easily be seen who has magazines and who has not. The new magazine is then sent to the person on the list for that magazine who has no reading material. This is true also of the magazines which have been out and are being returned. The two cards representing that magazine are taken from the files, a line drawn through the last date written after a reader's name, the reader's file looked over, the magazine redated and sent on to someone who has no magazine.

If the tickler file shows a magazine has not been returned on the date it was due, the day following a typed request is sent out, similar to that shown below:

Date....................

Mr....................................

Please return the following overdue magazines.

....

Thank You,

RECORD DEPT.

When the cards show a date after every name on the list, the circulation of that magazine is then complete as far as the list is concerned. A line is drawn through the column on each card to show it is no longer in use.

For the final disposition, the most important of the magazines are bound yearly or semi-yearly, and as complete indices come with them, any article may be very easily looked up. The rest of the magazines are disposed of in various ways. All are kept on file for one year, after which time, they are sent to the various departments, to take out the articles most interesting to them.

In comparing this method with others, the biggest advantage seems to be the quick and complete circulation of the magazines to so many people. The magazines do not go uniformly to the same people in the same routine each week or month, but instead each one has a fair chance to receive the new copies. This keeps the interest of all the people, for everyone is anxious to receive the new copies, and it proves an incentive to them to get right down to the magazine they have and read and return it promptly. It prevents one man having several copies lying around on his desk for a week or so, and then being a long time without any. This method also enables anyone in the plant to receive each copy of any magazine he desires. He merely sends his name in for the librarian to put on the list.

PLEASE RETURN TO RECORD DEPARTMENT BY ______	
Date	Name

FIG. 2—SLIP PASTED ON MAGAZINES

By a method mentioned in the *American Machinist*, Vol. 53, page 803, only certain persons who may be interested in particular articles were the ones to whom the magazine was sent. It seems to me it would be rather difficult to determine just what articles might interest each particular person, but when a person receives a magazine he can easily tell which articles he wishes to digest thoroughly, and which are of no value to him.

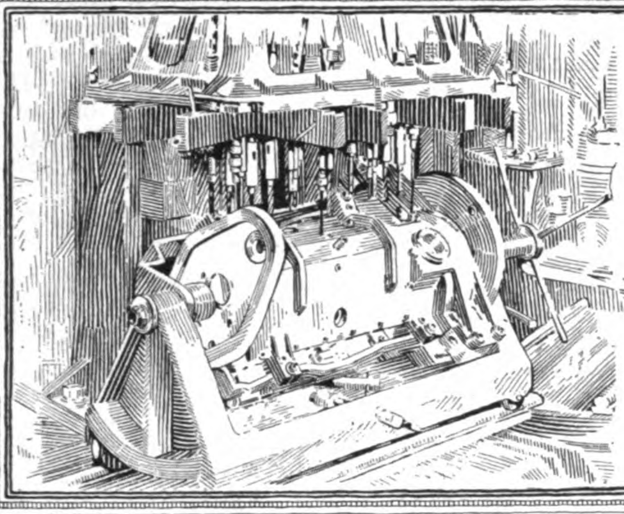
This plan has proved very successful for the past two years in circulating four weekly and nine monthly magazines, a total of twenty-five per month. Because of the long lists, each magazine travels to quite a number of people but as it is returned to the librarian each time there is no difficulty in locating it or any other magazine which anyone may wish to look up. Inasmuch, as this plan gives shop employees and officials an equal chance to receive each copy, to receive new copies at the earliest possible date, to have reading material at all times, and as it also enables us to circulate the magazines quickly, and finally to keep them in ways by which they are easily accessible, we feel that we are certainly using the trade magazines to capacity

Chink-in Work

By C. E. Jenson

"Chink-in work" is that which is taken on special contract or put in hand on the manufacturer's own initiative, to fill in time that otherwise might have to be paid for—with the alternative of having to close down, run on short time, or lay off hands.

Every manufactory should have a list of chink-in work that it could make, with a memorandum of the best probable markets for the output.



Tool Engineering

By
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President and Chief Engineer
Dowd Engineering Company, New York City

Details of Blanking Dies Continued—Plain and Automatic Stock Stops—Types of Mechanical Feeding Devices—Examples of Modern Die Design

IN FEEDING sheet stock through a die for a blanking operation it is necessary to provide an accurate stop so that the work will be produced with uniformity, and the waste of material will be as small as possible. On certain classes of work a positive stop is not always used, as the workman's eyesight may be utilized, and very good results obtained in this manner. In the example shown at *A* in Fig. 462 a die of this kind is illustrated. A sight hole *B* is placed in the stripper plate *C* in such a way that the workman can look down through the hole and see the edge of the work, thus obtaining the correct location for each successive blanking operation. The appearance when looking through the hole is indicated by the small detail shown at *D*. There are some shops that use this method almost exclusively, but the majority prefer something more positive and less subject to errors on the part of the workman.

Must Be Handy

In designing a stop for a given piece of work, it is well to remember that it must be so arranged that the operator can find it readily. He must depend upon his sense of touch when doing this, but care must be taken to make the stop in such a way that it will be as little trouble as possible. When the punch recedes from the work it pulls the stock up with it until it strikes the stripper plate, at which time the workman, by using a little pressure on the stock in a longitudinal direction, can slide it along to the stop just at the moment when the punch leaves the stock so that it is free to move.

A very simple form of stop is shown in the example *E*. It is a round pin *F* placed in the die as shown, so that after one blank has been cut out, the edge of the stock will come against the pin in such a position that the right amount of stock will be left between blanks. The enlarged detail at *G* brings out a point of importance in connection with the placing of stock stops. The pin *F* is too close to the opening in the die and a fracture might be caused if it were placed as shown. The distance *H* should always be less than that at *K*, so that stock can be moved freely over the head of the pin when feeding.

In order to prevent the placing of the stop pin too close to the edge of the die opening, a form like that shown at *L* is frequently used. Here the pin *M* has an extension end on it as indicated, so that the hole *N* can be placed a sufficient distance away from the die opening. Usually pins of this kind are made solid; but it is possible to use a design similar to that shown at *O*, in which the stem and extension are separate pieces fastened to each other in some approved manner. In general the solid type is to be preferred, as there is no likelihood of separation.

It is not always necessary to place the stock stop in the die itself. It can be positioned in the stripper plate, as shown in the example *P*, if this seems advisable. In this example the die is cut away at *Q*, so that the stock can be tipped to pass by the stop pin *R* which is set in the stripper plate. An arrangement of this kind may sometimes be found an advantage. Several other methods can be used when the stock stop is placed in the stripper plate. In the example *S* the stop *T* is pivoted, so that when in the correct position the small end lies down against the face of the die. The work *U* is passed through the die and pulled back against the stop to determine the right position. It can be seen that the stock will readily pass by the stop when feeding, but that any movement in the opposite direction is restricted by the stop falling down and striking the face of the die.

Automatic Stops

Another stop of very similar form is shown at *V*. In this case a coil spring is placed at *W* in order to make sure that the stop will be forced down and strike the face of the die. The action of the stock on the stop as it passes through the die is clearly shown in the example at *X*. Another form of stop is shown at *Y*, in which the spring used is of somewhat different kind and acts on the pin to which the stop is fastened. The type of stop selected is dependent to some extent upon the work which is being blanked and to the designer's own preference.

Stops which are automatic in their action to all intents and purposes can be applied to many kinds of blanking operations. An example of a stop of this kind is shown in Fig. 463. The diagram at *A* shows the stop

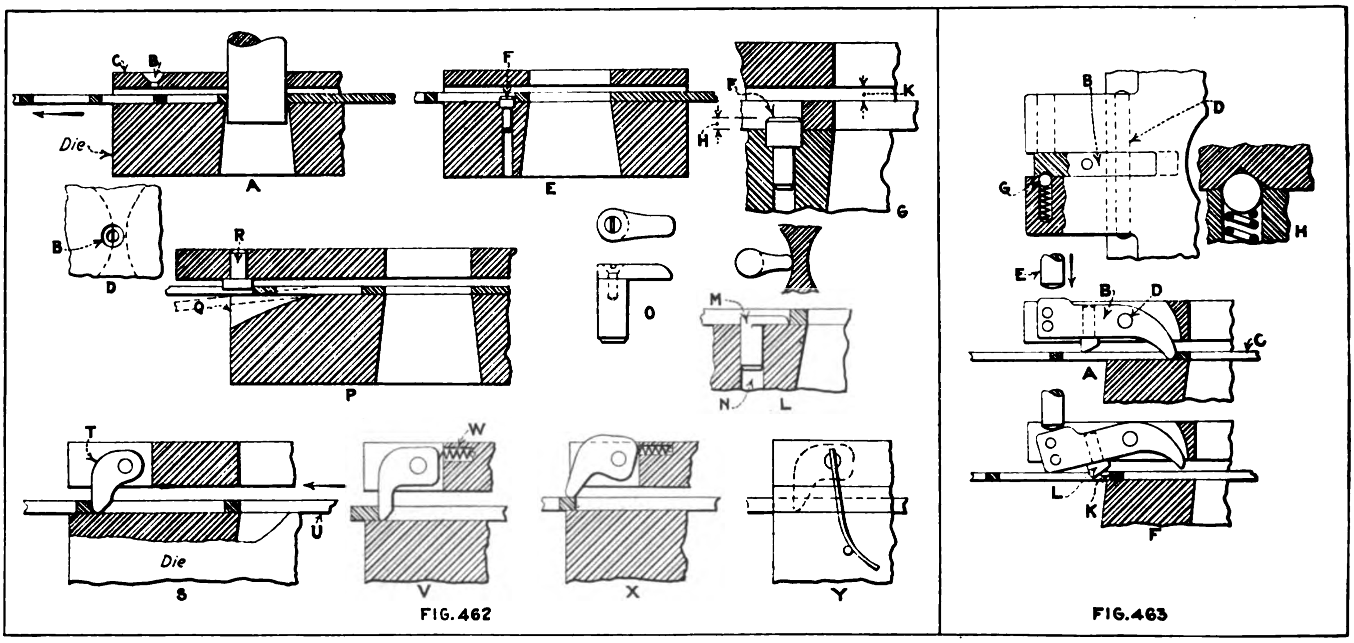


FIG. 462—EXAMPLES OF STOCK STOPS. FIG. 463—AUTOMATICALLY OPERATED STOP

B in position against the stock *C*, which is being fed through the press. This stop is pivoted at *D* on the stripper plate, and it is actuated by means of the pin *E* in the punch holder. As the punch comes down, the pin *E* presses down upon the end of the stop and causes it to take the position shown at *F*. Referring to the plan view it will be noted that there is a ball detent *G*, which snaps into a depression in the side of the stop after it has been pushed down by the pin *E*. An enlarged detail of the ball detent is shown at *H*.

The stop remains in the position shown at *F* until the punch has raised itself from the work, at which time the operator pushes the stock along so that the portion *K* strikes the pin *L* and causes the stop to assume the original position shown at *A*. When so located, a continuation of the feeding movement by the operator brings the stock firmly against the stop. The action of the press simply releases the stop, throws it out of the way and puts it into a position such that the forward movement of the stock in feeding automatically drops the stop and brings it down again to the locating position.

Punch presses can be fitted with standard stops when so specified. An arrangement of this kind consists of a pointed finger which is adjustable for various sizes of blanks. The finger can be so adjusted that at the proper time it drops into the hole punched at the preceding stroke, thus forming a positive and accurate stop.

Automatic Feeds

Mechanically operated feeds for punch presses may be grouped roughly into two distinct classes; *viz.*, first-operation work feeds, which are used on the rough stock before anything else has been done to it; and, second, other feeds which are applied to blanks or forms which have already been put through one or more punch press operations.

Considering first the feeds applied to first operation work, we have the following:

Roller Feeds, Single or Double. This kind of mechanically operated feed is applied to flat bars or sheets held between rollers by spring pressure. The feed is actuated intermittently by the action of the press.

Push Feeds. In this kind of power feed the work is held by stationary gripping fingers while the punching operation is going on. Between the strokes of the press the stationary fingers release the work, and sliding gripping fingers take hold of it and move it along longitudinally a pre-determined distance, after which the stationary fingers grip the work once more and hold it firmly while the sliding fingers return to their original position.

Reel Feeds. This type of feed is designed to handle flexible material in strips from a reel. The reel is arranged so that it has a brake on it, and the stock is

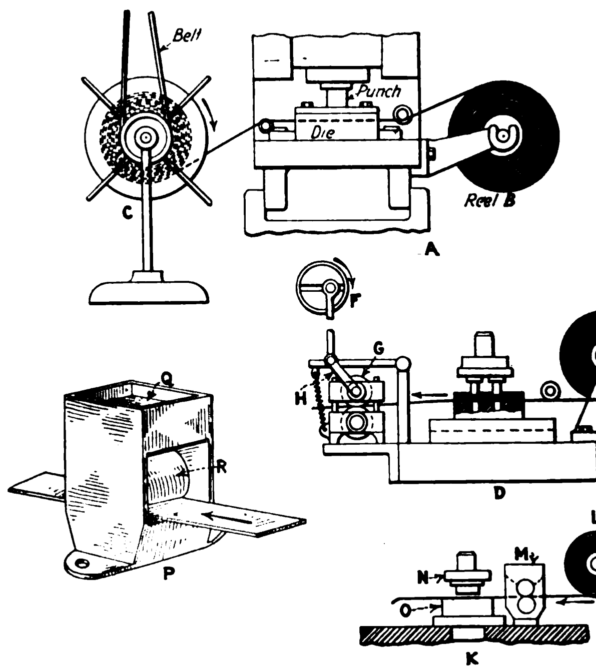


FIG. 464—APPLICATIONS OF AUTOMATIC FEED

pulled through the dies and wound on another reel operating intermittently between the strokes of the press.

Gravity Feeds. When the axis of the press ram is set at an angle to the vertical, so that the material

slides down the incline by gravity against a let-off gage placed at the rear of the dies and worked automatically, the feed is termed gravity feed.

The feeds in the second group are used only on work which has previously been stamped, blanked, or otherwise shaped on the punch press.

Dial Feeds. Feeds of this kind are used for forming, coiling, redrawing or repunching work. This type of device consists of a disk or dial which rotates intermittently, and which has a series of equally spaced openings or pockets in which the work is placed by hand. The dial revolves so that the pieces are successively located directly under the punch, and yet the operator's fingers are in such a position while loading that there is no danger from the punch.

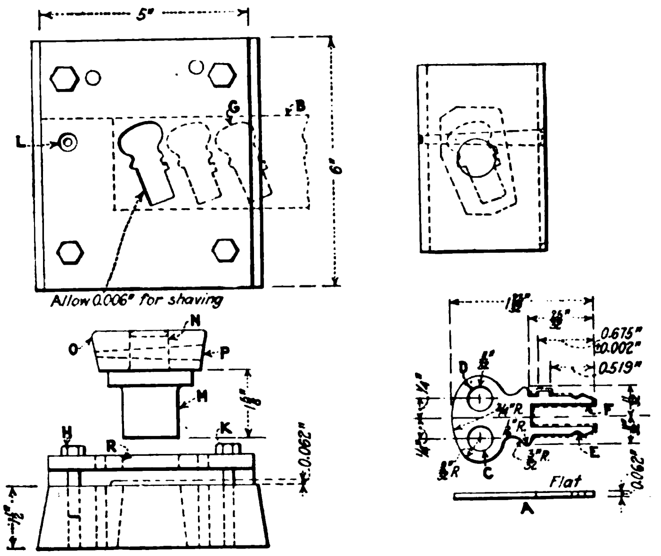


FIG. 465—EXAMPLE OF PLAIN BLANKING DIE AND PUNCH FOR KEY

Friction Disk Feeds. This arrangement is such that the articles are pushed from a table on to a revolving disk, by means of which they are carried by friction between guides or plates and thus delivered to the dies. Each piece is stopped by a let-off device which limits its movement as it is carried in to the final position.

Conveyor Feeds. Occasionally the lower die is so arranged that it conveys the work by swinging or sliding so that it comes into correct position under the upper die. This arrangement is termed a conveyor feed.

Carriage Feeds. This type of feed is of the reciprocating order. A carriage comes forward and receives the work, after which it returns between the dies and then repeats this operation for each piece handled.

Hopper or Tube Feeds. This type of feed is also occasionally termed magazine feed. It is used for small articles such as medals, coins, washers, locknuts, trade-checks and other work produced in large quantities. The parts are piled one on top of the other in a tube or magazine, and allowed to descend by gravity into a dial conveyor or carrier. Applications of this form of feed can be made in certain kinds of high production work to great advantage.

In order to illustrate more clearly the application of automatic feed to certain kinds of work, several diagrams are shown in Fig. 464. In the example *A* the stock is fed from a reel *B* through the dies, as shown, and to another reel *C* on which it is wound up. An arrangement is provided so that there is friction on the reel *B*, and the reel *C* operates intermittently at each stroke of the press.

Another method which is used for stock which comes on a reel is shown at *D*. Here the reel *E* carries the stock, which is fed through the dies in the direction of the arrow. The method of feeding is by means of the eccentric *F*, which operates the rolls *G* through which the stock is drawn. A pawl attached to the arm *H* moves the feed roll forward at each upward stroke of the press. The applications of ratchet feed have been mentioned previously.

Certain kinds of stock require oiling before passing through the punch, and the designer should bear this point in mind and provide an oiler of some sort so as to take care of the situation. An example of this kind is shown at *K*, in which the stock is fed from a roll *L* through an oiler *M* and between the punch and die at *N* and *A*. A simple type of oiling device is shown in the enlarged view at *P*. An oil chamber *Q* is open at the bottom so that it discharges on to a felt roll *R*. The construction of this device is naturally governed by the lubrication required and the quality and kind of material which is in process.

Examples of Blanking Dies

We have endeavored to familiarize the designer with the various points of importance in connection with the design of blanking dies. We have taken up all of the points of importance in detail, and we shall show only two examples of blanking dies in order to apply some of the principles which have been set forth in the article. Fig. 465 shows an example of a plain blanking die and punch for the key *A*. The drawing of the key is double size, in order that the dimensions may be more clearly apparent. It is made of 0.062-in. stock; the operations necessary on it are, first, blank, second, pierce, and, third, shave portions indicated by the dotted line.

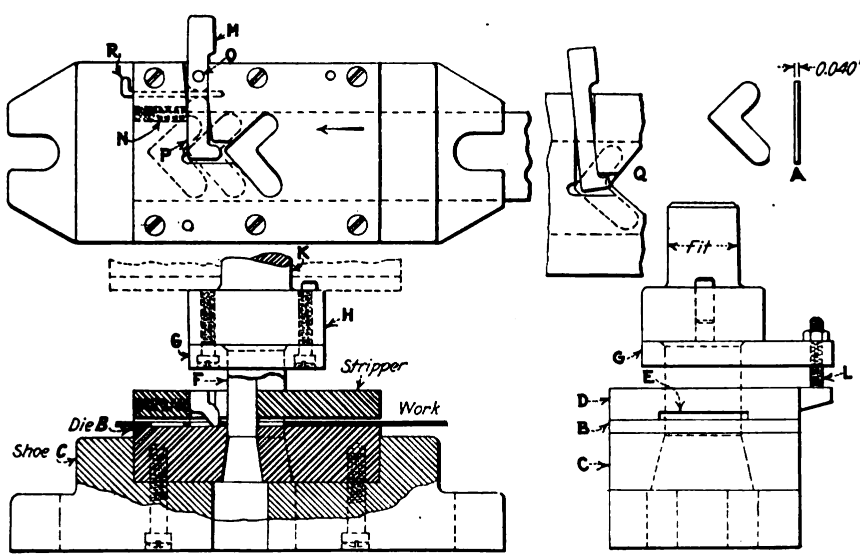


FIG. 466—GOOD EXAMPLE OF BLANKING DIE

It will be noted that in blanking, as shown in the layout *B*, the holes *C* and *D*, notches *E* and slot *F* are not produced. The holes and notches are afterwards pierced

and shaved. The blank layout is at a slight angle, in order to produce an economical run of stock. In the illustration the die is shown complete with the stripper plate, having a guide on one side only as indicated at *G*. The other side is open, but support for the plate is obtained by the two screws at *H* and *K*. The stripper plate is cut out where the punch enters, so that there is a slight radius on it as shown at *R*.

A sight hole is provided at *L*, so that the workman can adjust the stock properly for the first two blanks, after which the finger gage on the machine can be set for the regular run. The punch *M* has a round shank *N* which fits the punch holder *O*. The punch is held in place and located by a taper pin *P*. This is a véry good example of a simple and efficient blanking die in which a number of the principles previously mentioned are applied.

Another example of a blanking die is shown in Fig. 466 for the part at *A*. The stock in this blank is 0.040 in. thick and the blank itself is of irregular shape, as indicated. The die *B* is fitted to the shoe *C* and located by means of screws and dowels. The stripper plate *D* is of one-piece construction, being relieved at *E* to receive the work. The punch *F* is made to the shape of the part and has no flange or shoulder, but is fitted into the punch plate G and peened over to prevent it from pulling out. The punch plate is held on the punch holduer *H*, which has a shank *K* that is fitted to the press.

The finger stop shown in this die is somewhat different from those previously indicated. The punch plate *G* contains a screw *L*, which strikes the finger stop *M* on the downward stroke of the press. This raises the finger out of the work opening which has previously been cut by the punch, and the finger is forced toward the die opening by means of the spring *N*. The finger is then constrained to move down on to the stock again by the action of the spring *O*, and instead of going into the opening it strikes on the stock surrounding it. There is still pressure exerted on the stop, however, so that when the work is moved in the direction of the arrow the finger drops into the opening which has just been produced. As the stock is moved forward, the finger strikes against the portion of the stripper indicated at *P*.

The action of this finger stop is clearly shown at *Q*, where the finger is in the downward position before the stock has been moved along for the next blank. The finger *M* is held in position by the pin *R*. A taper pin is used as a pivot, and the hole in the finger is made large enough so that the required rocking action can be obtained. The hole is countersunk on both sides and a $\frac{1}{16}$-in. land provided in the center. In general, this die and punch may be considered as a good example of modern practice in designing blanking dies.

Finish Affects Maintenance

It is very rarely that an operative will not give a highly finished machine more care than one which is painted or left rough. Usually he will have more pride in the matter; but even if he has not, as neglect to wipe down shows promptly and may result in reproach or reprimand, the necessity for going over every part with waste to keep everything clean, enables detection of minor troubles that should be attended to, but that otherwise might go unobserved. The finish is a sort of long-life insurance.

The Passing of Craftsmanship

By Entropy

It is the fashion to deplore the passing of any old custom. The failure of modern mechanics to have the painstaking interest in their work which is seen in that of the men of a century ago is no exception to the rule. Is it a total loss?

These old time workmen did their jobs for the sake of doing them well. They derived a great deal of their reward for their work from the praise of their neighbors. The writer remembers an uncle who worked at odd minutes for months to make the smallest possible pair of blacksmith's tongs, forging them like a large pair. He succeeded in making one that was only about an inch long, but he would not sell it. All he wanted was to be able to exhibit it. If he had known of anyone making a smaller pair, his would have lost all value and he would have tried for the record.

Now very little of this spirit is seen in shops. It still prevails in sport, but sport and the shop come no nearer today than the use of horse shoes for "pitching."

Old Spirit Gone

What is happening, and quite rapidly, is that the draftsman, designer or engineer is setting up limits in the drafting room which are checked in the inspection department. The workman gets comparatively little credit for keeping within narrower limits than have been set for him. He is no longer able to take any of his work home to show the neighbors, and unlike the village smithy, the shop is not open to everyone that happens along to watch the workmanship of the craftsmen. Within the limits set for him all that is asked of the modern workman is production in as great quantities as possible.

After all, this is merely a shifting of the rules of the game. The product of the shop under the regime of limits and tolerances is as good as the nature of the work demands, as good as the public will pay for. Anything better does not add greatly to the customer's satisfaction nor to his well being. Extreme nicety of workmanship remains what it has always been, something to be exhibited, but the audience cannot get in to see the exhibition. It may be that these limits and tolerances have been made under pressure of the war and the succeeding madness too easy of attainment, and it may be that we shall see a tightening up of quality of workmanship, but that is rather doubtful in the machinist trade.

If it were cabinet making or furniture, which is sold for its beauty and apparent excellence of manufacture it would be different, but almost all machinery is extremely materialistic. There is very little opportunity for a mechanical device to appeal to the eye or ear through its beauty. In fact most mechanisms are today being housed in and so covered up that the engine of a high grade motor car looks like a block of solid cast iron. Its valve levers and even spark plugs are housed in under a cover or hood of its own. Mechanism is concealed as something essential but not to be admired nor too often inquired into by the uninitiated. There is a very good reason for this precaution for many an automobile driver is cursed with dangerously little knowledge of machinery and at the same time an appetite for tinkering which is likely to be appeased at the expense of the parts easiest to get at. For safety's sake fine workmanship must forego admiration.

Combination Piercing, Blanking and Forming Dies

Construction and Operation of Two Dies Which Replaced Four—Safety Features Taken Care of—Wearing Parts Easily Replaced and Adjusted

By C. J. DORER
Chief Engineer, White Sewing Machine Co.

IT IS OFTEN a puzzling task to combine piercing, blanking and forming operations to get the most out of a single die and thereby cut down the number of operations. The particular case which I am about to cite is one which was formerly done in four operations, and is now done in two. The cost of the two dies as now used, and hereinafter described, is slightly less than that of the other four. Also, the operating time was cut to fifty per cent of the previous operating time.

The piercing and blanking die is run at the rate of 112 strokes per min., the operator getting 67 blanks. The forming die is run at the rate of 42 strokes per min., the operator getting 42 blanks. In order to obtain such results, care must be taken to get all parts requiring the operator's touch into plain sight and easy reach. This fact is often lost sight of in the attempt to cut the original cost of the die. These dies were designed with the idea of being practical labor-saving devices and have proved to be so.

Varied Design

In the design, use was made of a number of schemes, such as a bushed stripper plate, disappearing pilots, spring and push fingers, a sectional bushed pillar die, kickers and spring pads. Such things are always of value to a designer of dies, even though the case may not be as complex as this one.

The piece described has two compound bends and is made of 0.060-in. stock, the smallest piercing punch being 0.078 in. in diameter. It will be noted upon examination of the blank that the corners where the double vertical bend takes place have been undercut so as to prevent the stock from tearing at this point.

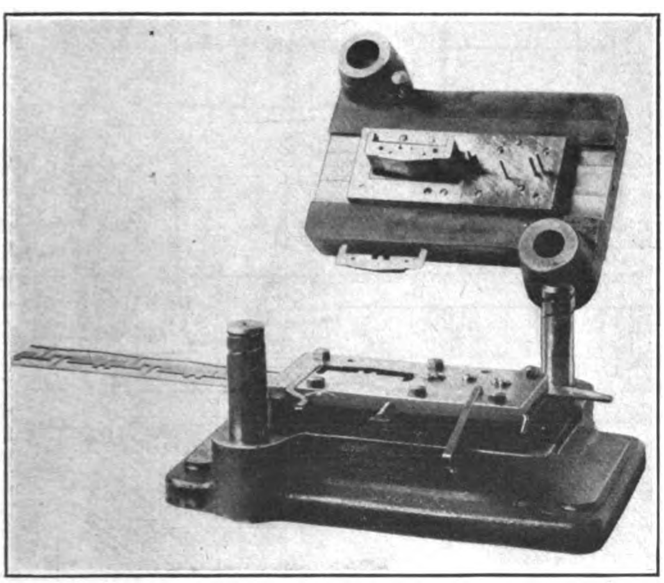
The blank and formed piece, also a section of the strip, are shown in the photographs of Figs. 1 and 2. It was necessary to hold the blank and pierced holes correct to 0.001 in. The pierced holes had a limit of 0.001 in., which meant that they could not increase in size as the die wore. In order to get the greatest amount of blanks out of the least amount of stock, the blanks were interlaced in the strip, as shown in Fig. 1. Owing to the staggering and interlacing of the blanks, the strip had to be started at a different point when going through the blanking die the second time.

Layout of the Blanking Die

The piercing and blanking die was laid out and built as a pillar die in order to maintain accuracy and cut the setting up time to the lowest possible point. It will be noted that the two pillars *A* and *B*, Fig. 3, are of different sizes to prevent accidental reversing of the die. They are placed across the corners to get as great a center distance as possible.

The die block was split in two pieces—C_1 and C_2. The split was placed between the piercing holes and material left for grinding, so that in case the blocks warped in hardening they could be ground and the center distance between holes maintained. The two blocks were set flush and screwed and doweled in the shoe in the customary manner. The same held true for the punch pad, parts D_1 and D_2, which was divided between the piercing holes and the blanking punch.

The stripper *E* was screwed and doweled to the die and the holes through which the piercing punches passed bushed with hardened tool steel bushings. The stripper was made in one piece and left soft so as to insure absolute alignment with the holes in the die.



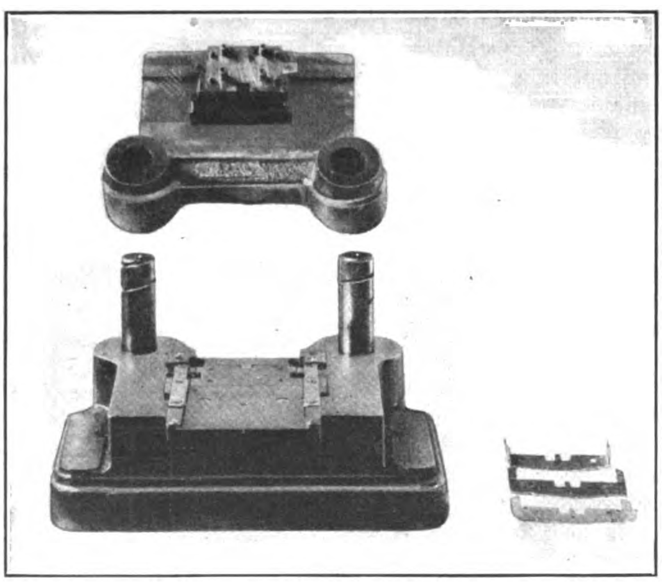


FIG. 1—BLANKING AND PIERCING PILLAR DIES. FIG. 2—FORMING DIE AND WORK

Owing to the closeness of the holes it was necessary to flatten the bushings F_1 and F_2 on one side, and press them in together. The punches G_1 and G_2 have a slightly enlarged shank to stiffen them as much as possible and to prevent the cutting edge from striking the bushings. The shanks are a sliding fit in the bushings. This was done to prevent the punches from walking on the stock, which is the ruination of any die.

Removing the stripper from a die is often troublesome, especially if it is a complicated one and parts of it are attached to parts of the shoe or die block. This diffculty was overcome in this case by building the stripper as a separate unit. It will be noted upon examination of the drawing that the stripper, back gage and other parts will lift off as one unit by removing the six cap screws and leave the die flush and even for grinding. By using cap screws for this purpose the stripper can be removed while the die is set up in the press.

Bushings H_1 and H_2 (see drawings) were placed in the die block in order to hold the holes to size. These can readily be replaced by removing the stripper, turning over the die and pushing them out from the bottom.

The blanking punch *J* was made in one piece and set in the left half of the punch pad in the customary manner by riveting over. The two pilots K_1 and K_2 are disappearing pilots backed up by springs, and are shown in section *Y-Y*. In case of a mispunch, or other accident, these pilots will push up and not set up a bad strain in the whole die. Such pilots are easily placed in any die by simply counterboring the punch and punch holder as shown.

The stock is fed in, as usual, from the right up to push finger *L*, which is normally held out by a spring. This is a flat finger which slides in and out in a slot and is prevented from coming clear out by plate *M*. After the first stroke of the press, the stock is fed to automatic finger *N* and with the next stroke a complete pierced blank is made. From then on the operation is continuous throughout the length of the strip.

Finger *N* is pressed down at each stroke by screw *P*, which is set in the punch holder, and is pivoted on pin *R*. The pin is easily put in and removed with the fingers. It is held in place by a set screw. Spring *S*, by its upwards and sidewards action, lifts the finger and lands it on the fin, permitting the stock to slide over for the next blank.

Owing to the interlacing of blanks, a third finger *I* was necessary when starting the stock through the second time. This finger had to enter the opening left by the first blank after the first run. A push finger could not be used, as it would strike the outer fin left by the blank, so a pivoted finger was used. It is pivoted the same as finger *N*, the operating end being held up by spring *U*. When using this finger the operator pushes it up, thus engaging the stock. To understand the necessity for this construction, one must study the blank and strip shown in Fig. 1.

In a die which is built low and compact as this one is, it is always advisable to have fingers which extend out from the die. Any design which tends to cause the operator to place his fingers under the punch holder should be avoided. It is apt to result in the loss of a finger or part of a hand. Too much emphasis cannot

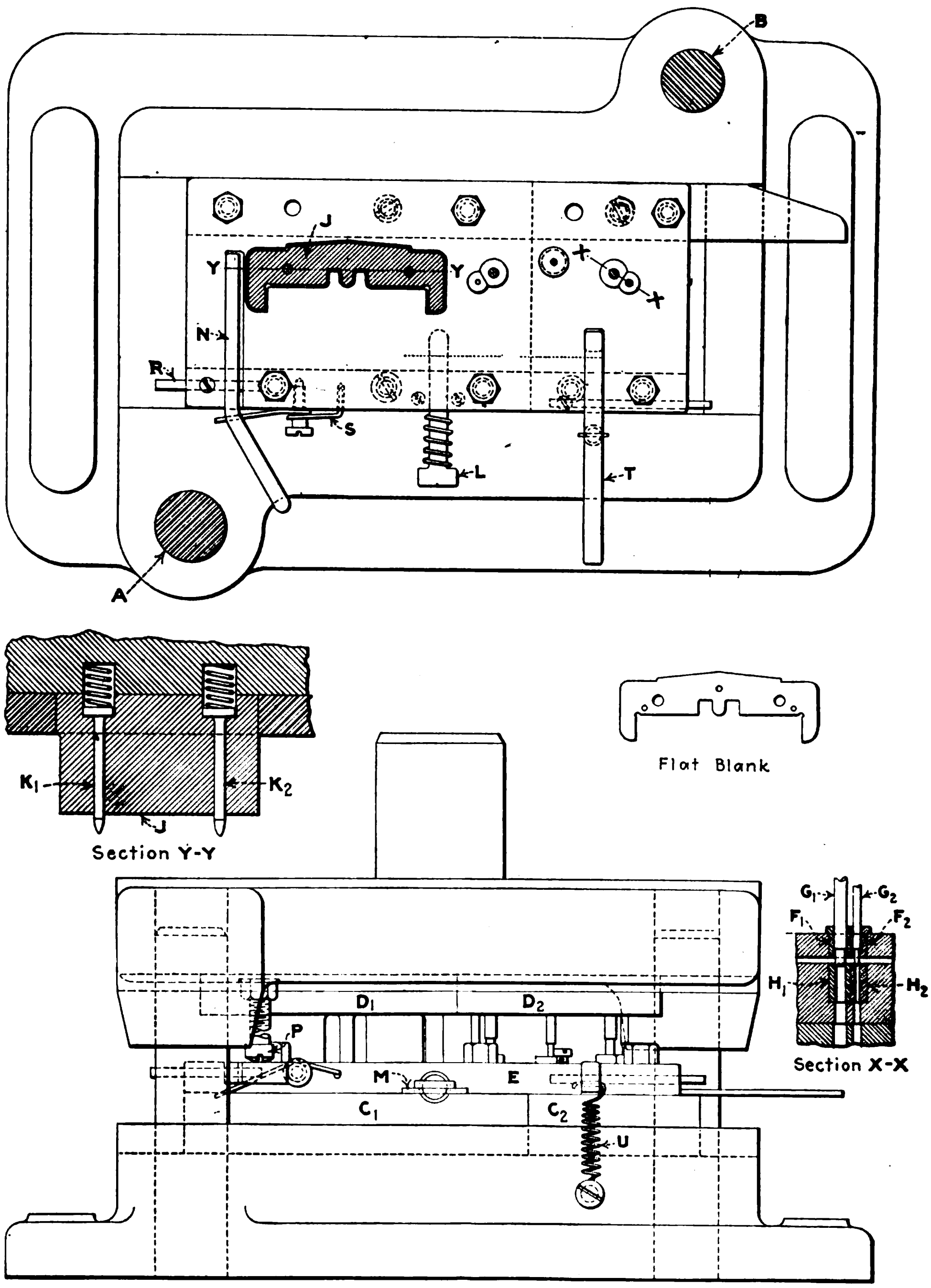


FIG. 3—PLAN AND ELEVATION OF BLANKING AND PIERCING DIE

be placed upon the fact that to make a die like this a paying proposition the wearing parts and points which must be held to size must be readily and cheaply replaceable. In this die round bushings pressed in are all that are necessary.

The forming die is also a pillar die and is sectional the same as the blanking die, in order to make wearing parts easily replaceable. It is built with a chute for feeding in the blanks and the gages are so placed that the formed blanks slide by and fall out the back. One blank is formed complete at each stroke of the press and two blanks are in the process of forming at one time. Figure 2 shows three blanks: one ready for forming, one partly formed, and one completely formed.

The blanks are laid upon plate *A*, Fig. 4, between guides *B* and are pushed forward by the operator, the plate being long enough to hold three or four blanks. The first blank, at the start, is just pushed over the edge of spring pad *C* and as the punch comes down it is formed and then pushed forward by the blank behind, which takes its place. Gages *D* then function as the stop and temporary locating medium. As the punch comes down, the sides and front point of the blank are whipped up. The sides are now away from gages *D*, and as the blanks are pushed forward the completely formed blank passes through and drops out of the die. Pilots are used for accurately locating the blank. The die goes to bottom so as to set the first form, which is made on die blocks *E*. The pad *C*, however, does not go to bottom.

The punch *G* is built of a solid piece of tool steel with four pilots *H*, two for each blank and four kickers *J*, two for each blank. The kickers are used for pushing the blanks off of the punch pilots.

Upon examination of the first form, it will be seen that the points of the blank are bent up and at an angle of 5 deg. This meant that these points could not lie upon the pressure pad *C*, but were obliged to extend out over it and be formed. This was accomplished by inserting the properly contoured block *E* on each side. The blank was engaged first by the central projection on the punch *G* and held square by the pressure pad *C* and accurately located by pilots *H*.

In the first form the points of the blank are bent down, and this meant that they would engage the blocks *K* and prevent being pushed through. In order to overcome this, kickers *L* were placed in these blocks, which raise the points up to their previous level and allow the partly formed blank to slide over. These kickers also serve to prevent the blank from being tipped over when the punch comes down, as the block is struck by the punch before it is gripped.

The pressure pad *C* had to be cut out so as to fill all the forming condition and have strong equally balanced springs. It is held from coming out by two filister head screws. The die is built up out of eight pieces, five of which have forming surfaces and are easily replaceable. Filister head screws set in from the outside are all that are necessary to hold them in place as the pressure in most cases is outward.

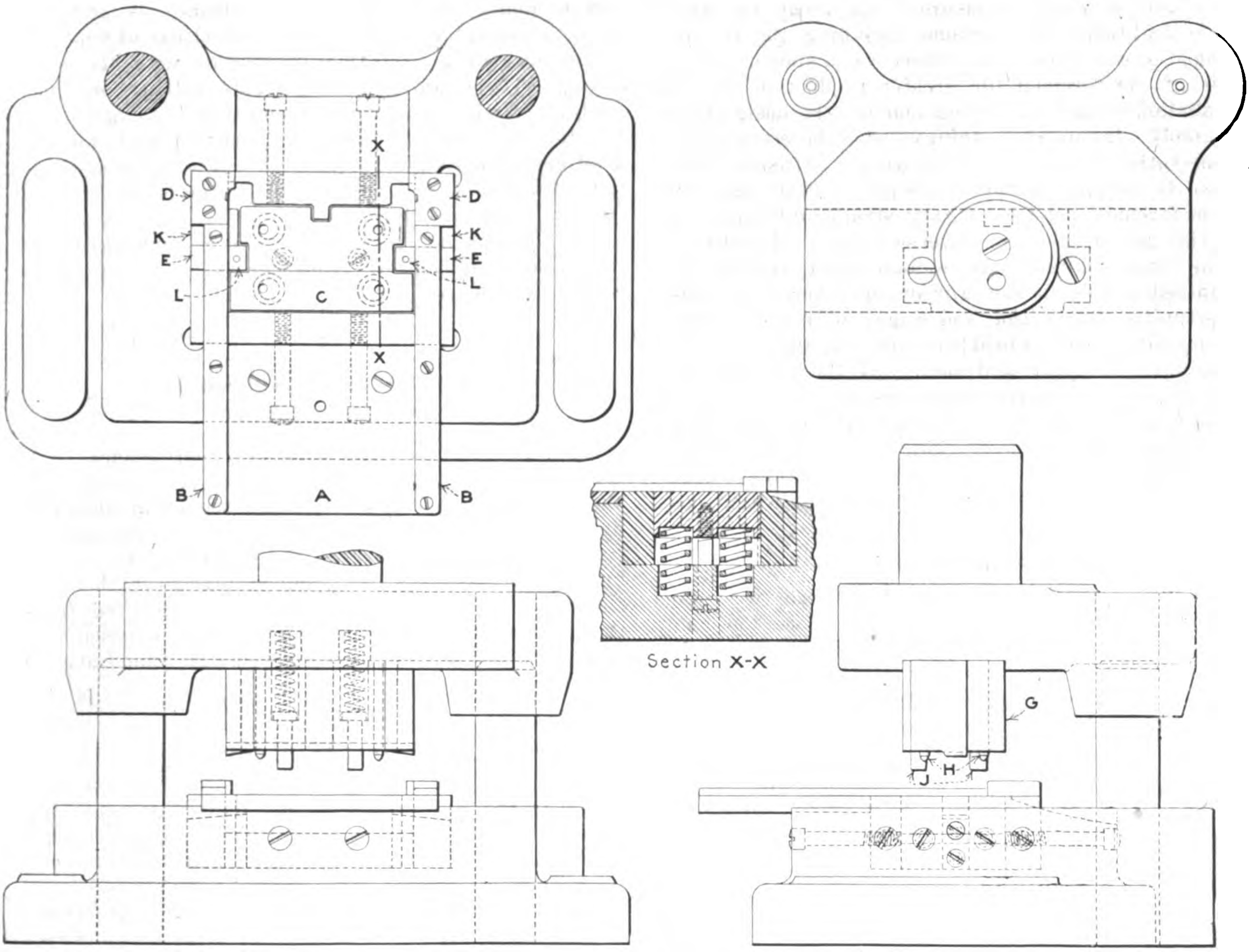


FIG. 4—PLAN AND ELEVATION OF FORMING DIE

The Foreman— Past and Future

By G. G. Weaver

On every side we hear of the need for greater production, the decrease in labor trouble, the reduction of costs, and upon investigation we find that the foreman is charged more or less with bringing about these necessary and timely conditions. The foreman, on the other hand, is positive that every person about the place indulges in that favorite indoor sport known as "passing the buck," which results in making him the "goat." The situation is worthy of a rather detailed consideration.

In the first place let us analyze the foreman's position so that we may have a fuller appreciation of his duties and obligations. The foreman occupies the same place in industry as the keystone occupies in an arched bridge. On one side are the workers and on the other side, the management, both demanding loyalty and co-operation. To the men he represents management and, as far as the men are concerned, his talk and his actions are management. To the management, he is the agent through which all the orders, desires and policies of the management are communicated to the working force. In other words, he is the medium or keystone through which the management functions.

Epoch-Making Period

We are now passing through an epoch-making period in modern commercial life, an era unparalleled for industrial and economic changes. These conditions are responsible in a large measure to the great war which was a nightmare to everyone, including the foremen engaged in war industries. There was a sudden demand made of the foremen for greater production, for the installation of new equipment and for the designing of new tools. Innumerable things had to be accomplished to meet the emergency. This great confusion, which tested the human endurance, was placed on the shoulders of the foremen, bringing with it strange difficulties, industrial unrest, new controversies, labor disturbances.

This state of affairs was no doubt due to the fact that untrained and inefficient workers discovered unlimited opportunities in position and wages, with the whole of the manufacturing world bidding for their services. In spite of the chaos and handicaps, the foremen were held responsible by the employers for increasing the production, meeting high standards of cost, and securing co-operation of the working forces, in addition to their regular routine duties. It is no strange coincidence that the foremen in many cases failed to meet the issue.

Must Study Foremen

The World War made employers realize two things in regard to foremen. In the first place too many duties which should have been handled by others in the organization have been delegated to the foremen. In other words, management, in the rush of affairs, failed to analyze the foremen's job. In the second place, management must devote more time and attention to the training of foremen, if it hopes to secure efficiency and harmony in its organization. As a result, many firms have re-arranged or re-assigned the duties which were formerly delegated to the foremen.

Many firms, the country over, are interested in giving training courses to their foremen to better enable them to cope with the problems which they encounter. Such courses of training are not designed or intended to improve the mechanical or technical skill of the foreman, but rather to teach them a better understanding of their position regarding the human factors which enter into their jobs.

Foremen who have taken such courses of training say that they have acquired a different idea of their job and of their relation to their men, and that these courses have given them the means to receive and give better co-operation throughout their organization as a whole. The foremen may be one of two things to his employer, either an asset or a liability.

The foreman who is an asset will: (1) Exercise a most human attitude to the employees without being weak; (2) be willing to assist the employees with their jobs and to instruct them; (3) be loyal to the management by properly representing them to the men; (4) give constant and exact supervision to the work as to quantity and quality; (5) display a willingness to co-operate with other foremen and other departments; (6) give assistance to the time study department in setting rates that are fair to the men and fair to the company; (7) make a constant effort to keep down the overhead expense; (8) prevent material and human waste; (9) be always eager to improve his ability by showing an interest in trade journals, lectures pertaining to civics, politics, modern methods of handling men, etc.

The foreman who is a liability will: (1) Fail to properly supervise his work; (2) use hasty judgment in handling his men; (3) lack interest in the men or a human quality in his relations to them; (4) criticize the management without complete knowledge of what he is talking about; (5) fail to co-operate with his associates; (6) be antagonistic to rate setting or time study; (7) misrepresent management to the employees; (8) fail to co-operate with the inspection and employment departments; (9) show indifference to the instruction of workers, and neglect to acquire leadership instead of being a driver.

The foreman has performed a big job and has overcome colossal difficulties. However, he cannot afford to rest on past laurels.

Penalties for Carelessness

By R. Grimshaw

I am out and out for penalizing carelessness. A man has no right to expose himself, much less his fellows, to danger. Therefore, when I see a man smoking in a garage I think he should not only be fined, for the benefit of his fellow workers, but handled a bit roughly by his associates. I am inclined to believe that his efforts to enlist the aid of the police (recruited from the working classes and themselves daily exposed and exposing themselves to danger) would be comparatively fruitless.

Utilizing Wall Space

There are few manufacturing establishments that utilize to the full, even if at all, their wall space and yet it affords excellent opportunity for affixing shelves, racks, piping, transmission, cranes and hoists, maps, plans, etc. By their use we succeed not only in economizing or supplementing floor space, but in saving time and wages otherwise spent in going after things which might just as well be before the nose.

Investigation of Steels for Gages

The Bureau of Standards program for the laboratory investigation of gage steels is as follows:

The chief properties desired in gage steels seem to be (1) resistance to wear, (2) minimum dimensional changes on hardening, (3) freedom from dimensional changes with time, and (4) machinability. To properly outline a program of experiments seeking to obtain these independent properties in the highest degree, it is essential to analyze each separately and determine the important factors contributing to it. Because the existing knowledge of many of these factors is very limited, only a preliminary analysis of the problem of determining their function is possible now.

With the progress of experiments on the fundamental factors involved, it should become clear what precautions are necessary and what the crucial experiments to be performed are, thus eliminating inconclusive and negative data in the principal series.

Amsler Abrasion Test

Resistance to wear generally accompanies hardness, a property necessary in gages to prevent distortion on handling. On this account, wear need only be considered in steels of the martensitic class, or those not far removed from it. Resistance to wear, however, is higher in harder steels than in soft ones and there is still a wide range of values possible for any given hardness. The ultimate criterion of this property is, of course, the length of service under uniform conditions, although this is impracticable for any extensive investigation. It is usually inconsistent unless a large number of specimens are used because of the difficulty of securing uniformity in its execution. Moreover, it is highly desirable to obtain a quick wear test.

For this purpose the Amsler abrasion test machine has been decided upon. This machine produces dry wear on the periphery of two disks by means of a combination of rolling and sliding friction. The test pair may be identical or one a standard and the other the test piece. The latter is often the best method as the true value of a good block would probably not be indicated when tested against itself. It is also desirable to use a hard standard to get faster action, but this does not reproduce service conditions as closely as a soft standard. The two methods must be compared.

Comparison of Results

After the technique of this test is worked out, it will be necessary to compare its results with those from service tests on identical metal. While there may be no close relation found between the two, the quick test should at least show steels worthy of a service test.

The preliminary work planned for the machine, to test its reliability, consists of running two carbon steels. SAE 1020 and 1090 respectively, hardened by Pratt & Whitney Company, and oil hardened "Ketos" steel. These disks will be tested against themselves and against hard and soft standards, both as hardened and as tempered. It is expected that data secured will show the possibilities of this test for further work.

When the above test proves satisfactory, the effect of other alloys of variations in constitution should be studied. Of particular interest is the effect of chromium and tungsten, individually, and also of austenite in the structure. Hadfield's austenitic manganese steel is very resistant to wear, and, although too soft for the present purpose, it is possible that conditions intermediate between martensite and austenite may afford a good combination of hardness and wear resistance. Such a combination offers a possibility of reducing internal stress, as will be noted later.

Dimensional Changes on Hardening

Changes in dimensions on hardening are caused by at least two independent factors, (1) thermal stresses and (2) the volume change of the transformation of austenite to martensite. The thermal stresses are inherent in any quenching operation and cannot be avoided. The undesirable feature of the distortion produced by them is its non-uniformity. We know that it can only be uniform in a symmetrically cooled body such as a sphere, unless elaborate precautions are taken. The stresses can, of course, be practically eliminated by using a steel of so slow a critical cooling rate that it will harden all the way through on cooling in air. Unfortunately, however, there is available no satisfactory commercial steel of this type having good machinability. It is essential therefore to consider means for avoiding thermal stress distortion in appropriate oil-hardening steels.

To study thermal stress distortion it is necessary to eliminate other factors contributing to dimensional changes. Of these the volume change of martensite formations is most important. For this purpose a steel austenitic and stable, at ordinary temperatures, is required. The principal sources of stress, temperature gradients on heating and on quenching, must also be studied independently.

Quenching Power of Baths

The quenching experiments will require a knowledge of the quenching power of the baths used. This information makes possible also another important determination, the critical quenching rate of the steels used. It is desirable to use as slow a cooling rate as will give penetration of hardening to the center. On the other hand, it is essential to use a treatment which completely hardens. This introduces another variable which affects the dimensions profoundly and is very difficult to control.

The other important source of dimensional changes is the volume increase of austenite transforming to martensite. While the volume change is constant for any steel and treatment, it is not possible to say whether or not the dimensional changes due to it vary between different points in the same specimen. It is quite possible that they do, as the transformation must progress through the soft metal when the thermal gradients demand, thereby producing stress between the transformed and the untransformed metal. The untransformed metal, austenite, is soft and readily deformed plastically, and distortion may easily occur. To investigate the source of distortion, the quenching stress effects must be eliminated, as is possible by using a steel austenitic at ordinary temperatures, but convertible to martensite above the temperature of liquid air. These experiments should be carried out on specimens of at least two ratios of length, for example, to diameter 4:1 and 1:1.

If this condition proves to be a serious source of distortion, methods of avoiding it must be studied. Two possibilities are evident; either the temperature of the quenching bath may be raised and the specimens slowly cooled in the bath, thereby reducing the stress between

the martensite and austenite; or alloy additions may be made which decrease the intensity of the volume change.

The changes in gages on ageing are quite irregular. Some steadily increase in length and others decrease, while some change erratically. sudden changes in length and planeness are assumed to be due to stress effects while the uniform changes are very likely the result of slow changes in the constitution. Hardened steel is known to temper slightly at ordinary temperatures and this appears to be the constitutional change producing the dimensional changes. Martensitic steels decrease in length on moderate tempering and semi-austenite steels increase. It is quite probable, therefore, that the presence of a small amount of austenite in the matrix is responsible for the increase in length of gages. The magnitude of these factors should be determined by length and time measurement, starting as soon after hardening as possible, on blocks hardened to give maximum and minimum stress and definite ratios of martensite to austenite.

Omit Tempering

The ageing changes continue over a period of months, even years, so it is desirable, as far as possible, to shorten the length of time required to give definite results. This can be accomplished and the total effect magnified by omitting tempering. It appears safe to assume that a block which has good ageing properties untempered will have better qualities as tempered. It is essential to study the effect of tempering but the choice of tempering temperatures will depend more on wear tests than on ageing.

It is almost impossible to eliminate all time changes by the above method. It is important, therefore, to investigate artificial ageing, the usual method, of which, is both a temperature cycle and a stress cycle. The latter may be expected to develop any weakness in the block, but probably has little effect in establishing constitutional equilibruim. On the other hand, if the benefit is conferred by the temperature cycle alone, there appears to be no reason why it should be repeated. It may be possible to simplify and render more effective the ageing treatment by studying independently the thermal and stress cycles.

Machineability

This important property is not determined in the routine manner because of the difficulty of producing uniform tools and of determining the end point of the test. Since, however, the life of a tool depends largely on the temperature it acquires in cutting, the temperature developed in a tool under standard conditions appears to offer a reliable criterion of the machinability of the steel cut. It would be necessary to run the tests at speeds which would not dull the tool rapidly but this is not objectionable, most of the machine work on gages being in the nature of finishing. Such a test has the desirable feature of being simple, quick, and positive.

By investigating the four essential properties of gage steels, in the manner outlined here, it should be possible to determine the relative merits of the collection of commercial steels available, as regards each property. With this information available, it should be possible to develop compositions giving better combinations of the properties than any yet found and to select, at the same time, from the tested steels, the one which has the best combination of properties for a set purpose.

New Industries and New Tools

By Entropy

No one buys machine tools except for the sake of the profit which it is expected they will earn. Not many firms throw out old machine tools to substitute new ones. The cost of installation plus the low prices usually obtainable for the old machines make anyone stop, look and listen before doing anything of the kind.

But it is not very often that a new concern, just starting up, fits out with second-hand machinery. That is just the one time when they usually have plenty of money, and they buy their equipment before they discover how much capital is tied up in product in process of manufacture. Relief of the machine-tool situation then depends, not on any general improvement of existing business, but on the development of new businesses.

New business depends on invention or discovery. The automobile business was the salvation of the machine-tool industry while it was developing. To be sure, the automobile shops robbed the machine-tool factories of their best mechanics, but they also gave these shops the trade that kept them from the rocks.

Is there any hope for some fad that will call for the formation of new mechanical industries? If there is, and no matter what it is, it will inevitably react on the machine-tool situation. Is there to be some development of radio work that will make great demands on light machine shops, and help the bench-lathe and milling- and drilling-machine people? Is there to be development of airplane manufacture that will call on shops of the same class as the automobile shops?

Depends on Forethought

Is there to be some new mechanical musical instrument? Whatever it may be, we can rest assured that it will be something mechanical. Today everything that is material at all has become a matter of machinery. Our tables groan under the weight of books, papers and magazines, made possible by printing presses that required machine tools to build. Clothing, food, dwellings and shops are all machine made, and the machines made by means of machine tools. What is the next thing?

To be sure, no one knows what will come next, but this much is sure, that the builder who finds out what is coming and prepares to meet the demand is going to make more money out of it than the man who only wakes up because some dealer comes and insists that he supply the tail end of a demand that is already passing.

How can anyone get near enough to this elusive "next thing" to put salt on its tail? Only by keeping posted on events all over the world. The new fad is as likely to originate in the brain of one man as another. If it should be demonstrated that there is life on Mars, the telescope makers would have to run day and night to supply the demand. If someone stumbles on a new light that is not accompanied by heat, those who make the machinery with which the light is made will have to hire storage vaults to hold their profits. The next invention to become profitable may already be hidden in the pages of the Patent Office Gazette, a safe and sure hiding place. Who is going to find it?

A Correction

In the article on Methods of Machine Tool Design the bore referred to on page 561, first paragraph, 17th line, should have been 20 in. instead of 10 in. as printed.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Planing a Helical Surface

By William Denton

There is a machine much used in slate quarries for trimming the slate. The machine has a cutter head quite like that of a lawn mower except that it is heavier and carries but one blade. It is very essential that this blade, which is of thin steel, should be firmly supported throughout its length by the iron of the cutter head and that it should conform to a true helical curve. The

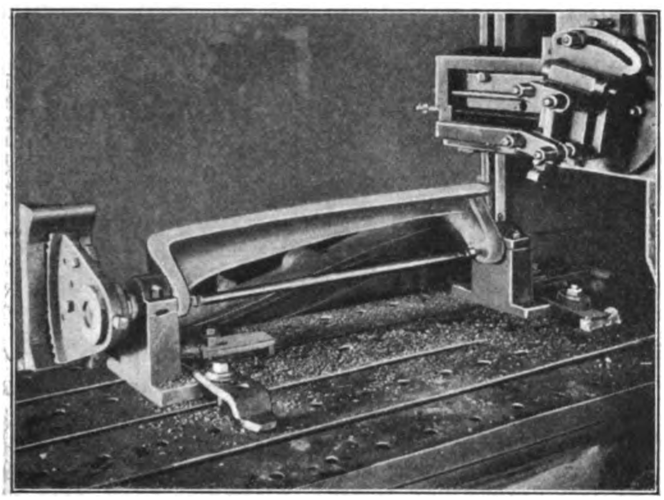


FIG. 1—FIXTURE FOR PLANING A HELIX

manner of planing the helix is shown in the illustrations.

To the back of the planer bed, opposite the operator's position, there are bolted two brackets to which is attached a taper bar very much like that used on a lathe for turning tapers, except that it stands in a vertical instead of a horizontal plane. A pair of centers are fastened to the planer table at the right distance apart to take the cutter head to be planed. To the "live"

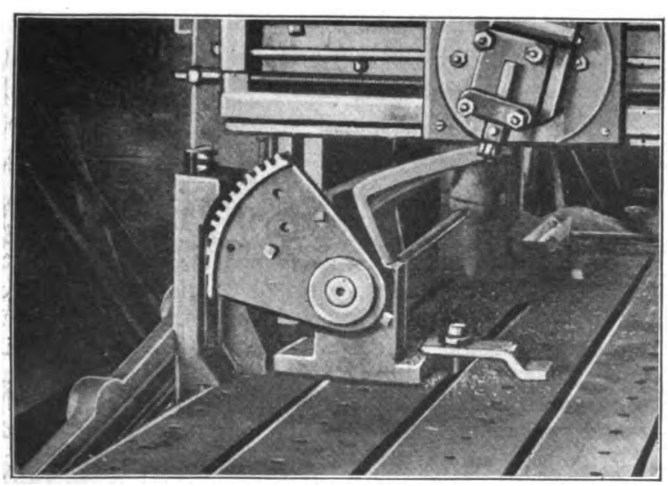


FIG. 2—END VIEW, SHOWING SEGMENTAL GEAR AND RACK

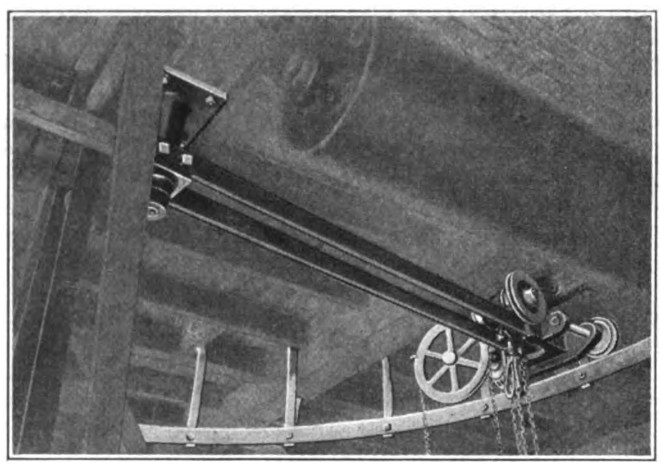
center, outside the bracket, is keyed a segmental gear that meshes with a short rack carried in an upright position by a slide that is a part of the "headstock" bracket of the centers.

In the lower end of the rack is a stud upon which swivels the block that slides in the dovetail groove of the taper bar and causes the rack to rise and fall as the planer table passes to and fro. Fig. 1 shows the fixture with a cutter head in place that has just been planed and in Fig. 2 may be seen the segmental gear and rack in extreme position. It is obvious that any desired helix within the capacity of the device may be obtained by merely adjusting the angle of the taper bar.

Home Made Crane to Serve Large Lathe

By Milton Wright

The crane shown in the illustration was made to serve a large lathe and was put up many years ago when it was not as easy to obtain machinery for this purpose as it is now. The central stud upon which the arm swings is attached to the beams that support the floor above, directly over the center line of the lathe. The arm itself is made of two pieces of iron of rectangular



OVERHEAD CRANE TO SERVE A LATHE

section attached to a casting which turns upon the stud and, at its outer end, to a two-wheeled truck running upon the semi-circular track, also supported from the floor beams.

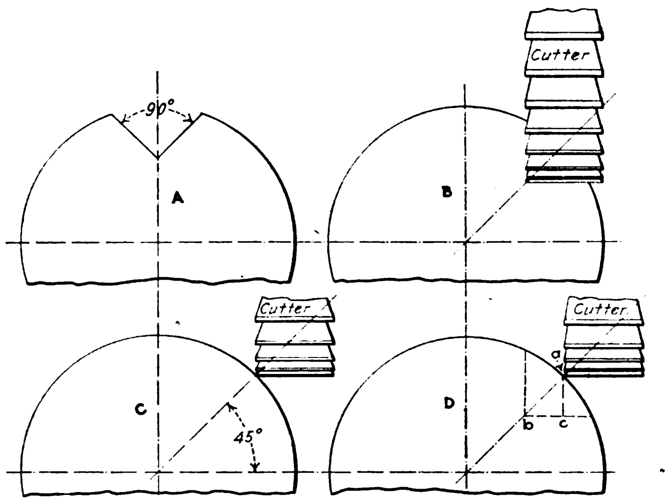
The arm with its two parallel members forms a track for the trolley from which the hoisting block is slung. As the length of the arm is about half the length of the lathe bed, a load may be supported over practically any portion of the length of the latter and, as the arm swings out to a right angle, the load may be conveniently deposited upon the floor or a truck at the rear of the lathe. The crane was built at the Bennington Machine Works and has been in service for many years.

Solving a Problem

By R. H. Kasper

The writer recently saw a workman overcome a difficulty in a rather ingenious manner. A disk required a 90-degree V milled in the circumference to a specified depth, as shown at *A*. In the absence of a 90-degree V-shaped cutter and with only a plain milling machine at hand, the workman decided to use a square cutter by cutting at a point off the center, as shown at *B*. The proper distance off center and the depth to be cut at first puzzled the man but, having a knowledge of simple mathematics, he proceeded as follows.

He first set the disk with the center line at an angle of 45 degrees with the milling machine table. He then set the table so that the corner of the cutter just touched the disk at the point of intersection of the center line with the circumference, as at *C*. With this as a starting point, he drew in his imagination the triangle *abc*, as shown in *D*. As the distance *ab* was given, it was merely necessary to solve for the length of the sides *ac* and *bc* by the formula $ab^2 = ac^2 + bc^2$.



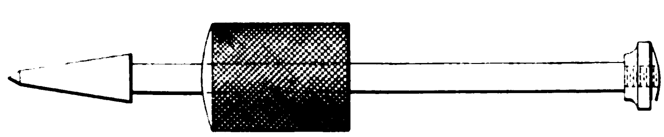
STEPS IN THE SOLUTION OF THE PROBLEM

As the sides *ac* and *bc* are equal, the side *ab* squared will equal twice the square of either of the other two sides. To find the length of the sides *ac* and *bc* it is necessary to solve for $\sqrt{\frac{ab^2}{2}}$. The length of the side *ac* gives the distance which the milling machine table must be raised and, as *ac* and *bc* are equal, it also gives the distance which the table must be moved to one side in order to give the required depth to the V.

A Weight Actuated Prick Punch

By L. J. Gagnon

A simple and effective prick punch of the "automatic" type is shown in the accompanying sketch. The body of the tool is made of drill rod, properly hardened and ground all over. The cap button is screwed to the upper end, the sliding weight being made of a conveniently larger size of stock, knurled, hardened and blued, for the sake of appearance.


AN AUTOMATIC PRICK PUNCH

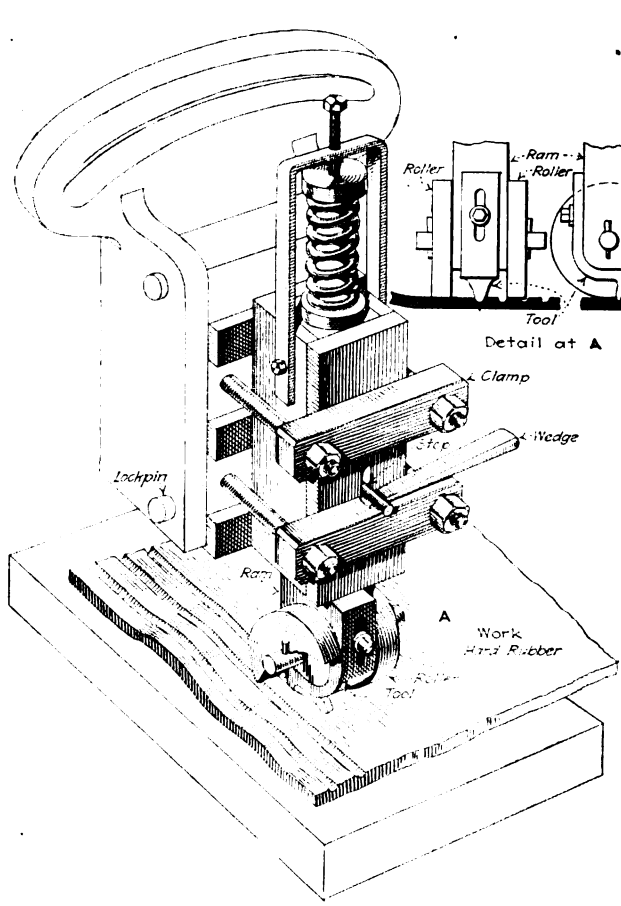
To use the tool the weight is held between the thumb and middle finger, with the index finger resting upon the cap button. The point is then located at the line intersection or other place that it is desired to mark and the weight released. This tool possesses an advantage over the spring actuated type of automatic in that the point will "stay put" and will not jump away at the instant of striking. There is no recoil. If a deeper impression is desired the weight may be raised and released several times.

Planing Vulcanized Rubber

By Bert Crouse

While working at the Youngstown Foundry & Machine Co., Youngstown, Ohio, we had a hard rubber plate 18 ft. long, 4 ft. wide and ¼ in. thick in which grooves $\frac{1}{32}$ in. deep and ⅛ in. wide were to be planed the full length, covering the whole surface.

While the rubber was hard to cut with a regular metal cutting tool, the great difficulty was due to its irregular surface and its warped condition which prevented it from lying flat on the planer table. It was utterly impossible to get a good job by planing it in the regular way, as the tool would cut deep in the high places, so the device shown in the accompanying sketch was made. A cast-iron box was made to suit the toolpost and fitted with a ram which carried the tool. Two pressure rollers were attached to the ram and a coil spring mounted at the top of the ram sup-



RIGGING FOR PLANING VULCANIZED RUBBER

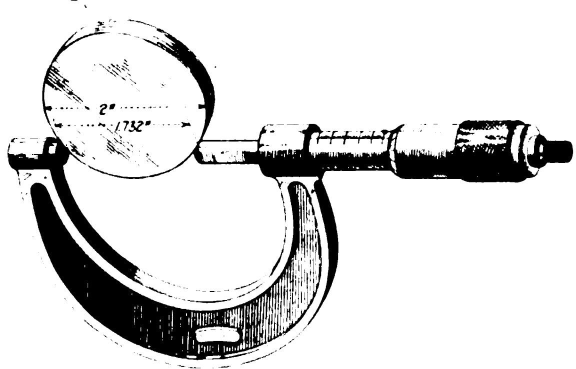
plied the tension to keep the rollers against the work. A stop-pin screwed in the ram midway of its length permitted it to move up and down through a slot. Pushing a wedge between the stop-pin and tool clamp at the end of cutting stroke would raise tool up for the return stroke, pulling wedge out at the beginning of cutting stroke would let tool down to cutting position. The apron was locked with a lock-pin as the pressure on the rollers tended to lift it.

This device enabled us to make a good job out of what seemed an impossibility.

Equal Divisions on Periphery of Disk

By Robert F. Smith

To divide circular work into more than two parts I find the method shown by the accompanying illustration to be simple and accurate and much more convenient



DIVIDING CIRCULAR WORK WITH MICROMETER

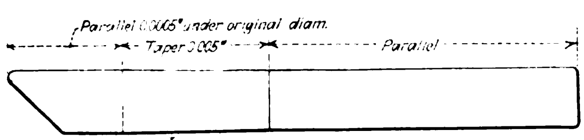
than using dividers for the same purpose. The disk shown was 2 in. in diameter by $\frac{1}{16}$ in. thick and was to be divided in three parts.

By reference to a table of regular polygons the length of a side may be found by multiplying the constant there given by the radius of the work. In this case the result is 1.732 inches. First scribing a starting point on the periphery of the disk by means of a try square, a micrometer is set to the required distance of 1.732 in. and the remaining two points determined by placing the tool against the work as shown.

A Small Reamer That Is Easy To Make

By F. B. Shoemaker

In tool work it is often necessary to ream small holes for which there are no standard reamers and the toolmaker is obliged to make them for the job. A reamer that is very quickly and easily made and will prove very satisfactory is shown in the accompanying sketch and is herewith described. If a hole is to be reamed to, let



A QUICKLY MADE REAMER

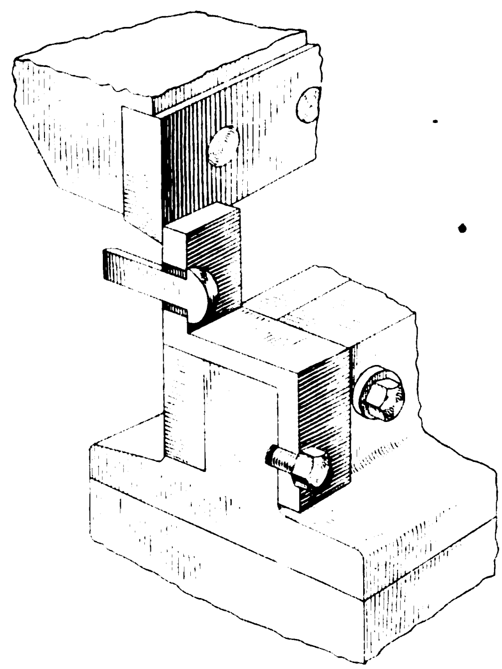
us say, a drive fit for a certain size of drill-rod, cut off a piece of the rod long enough to make the reamer. Put it in the chuck or collet of the bench lathe and polish down a short distance on one end, equal to one and one-half diameters, to a diameter 0.0005 in. under the original size, taking care to keep this part parallel.

Turn the piece around in the chuck and catch it by the new diameter. Then, with a file, taper it back for an inch or so of its length to a diameter of about 0.005 in. under the original size. From this point to the opposite end it should be made parallel and of the smaller diameter. Next, file or grind an angle of about 45 deg. across the cutting end, as shown in the sketch, and round off the sharp corner about a quarter of the way to allow the tool to enter the hole easily. In hardening, do not dip more than $\frac{1}{2}$ in. of the length and thus avoid warping.

Emergency Method of Cutting Rivets

By John J. O'Weil

Having about six hundred $\frac{3}{8}$-in. rivets to cut to length in a hurry, there being none of the proper length in the shop, and the only machine available being a shear, we rigged up the device shown in the sketch. A piece of wrought iron was bent as shown to go over the lower


CUTTING OFF RIVETS IN A SHEAR

shear blade and held in place by drilling and tapping one $\frac{3}{8}$-in. hole in the lower holder.

A hole through this wrought iron bracket accommodated a tool steel bushing of a size to take the rivets, the bushing being forced to place and set with the cutting face flush with the surface of the bracket, so that the upper blade would pass close to it. The entire time of rigging up and cutting the 600 rivets was less than three hours.

Distinct White Graduations

By P. A. Daschke

Clear white legible reading is accomplished on steel scales by brushing them over with Chinese white, allowing it to dry and wiping off the surplus against the graduations with a soft cloth.

Shaving Pinions in a Safety Punch Press

By Herbert Crawford

The gearing in the recording mechanism of the meter made by the Neptune Meter Co., Long Island City, N. Y., uses many small pinions. These are finished by the shaving process in the press and die shown in

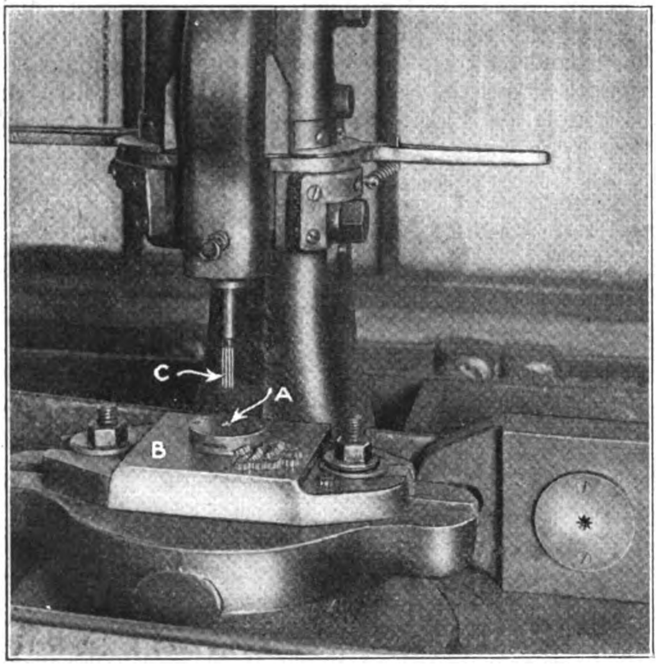


FIG. 1—PRESS FOR SHAVING PINIONS

Fig. 1. The pinion, which has already been cut, is placed in the nest *A* which is fastened to the shaving die *B*, and forced through the die by means of the plunger *C*. This gives an excellent finish to the teeth and is very rapidly done.

To insure safety to the operator, the double hand control is used as shown in Fig. 2. This device requires both hands to be up and out of the way before the press can be tripped, so that there is no chance of getting them caught in the press.

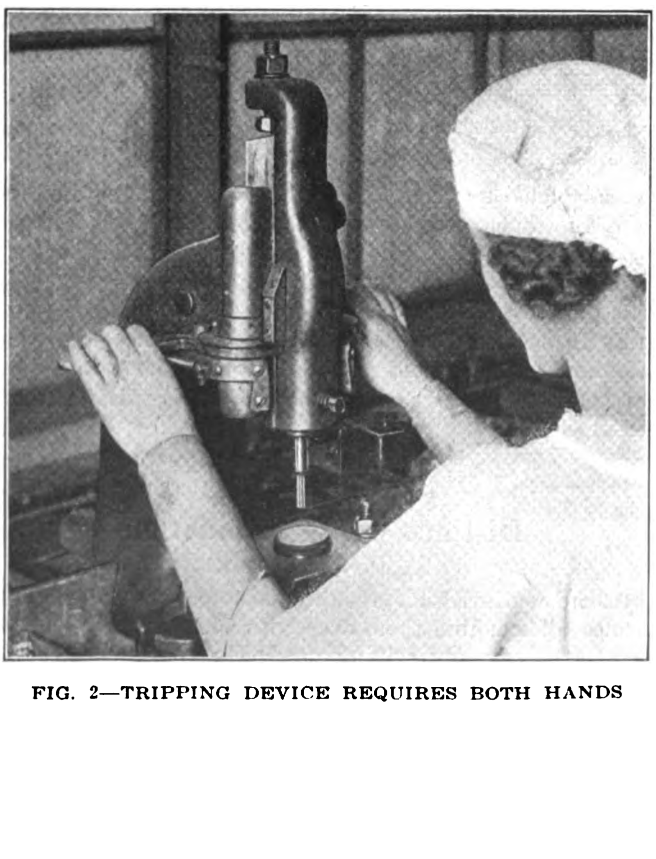
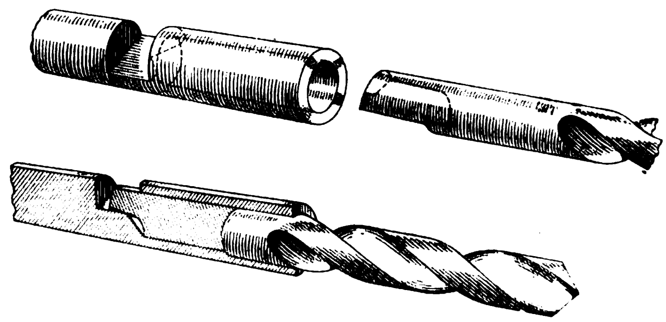


FIG. 2—TRIPPING DEVICE REQUIRES BOTH HANDS

Extension for Twist Drills

By F. B. Shoemaker

A good scheme for extending twist drills when the extension may be larger in diameter than the drill, or to fasten straight shanked drills in the taper shanks of broken or worn out taper shanked drills is shown in the accompanying sketch. With a drill a size smaller than the one to be extended, drill into the end of the extension or taper shank parallel with its axis for a distance



EXTENSION FOR STRAIGHT SHANKED DRILLS

of about three times the diameter of the drill and then ream out this hole with the drill to be extended.

Next file a slot across the extension at right angles with its axis, with one side of the slot coinciding with the bottom of the drilled hole. The depth of this slot should be such that the bottom just reaches the center line of the extension. Now grind away one half the diameter of the drill shank for a distance equal to the width of the slot and drive the drill into the extension so that the flats overlap. Making the length of flat on the drill a trifle longer than is necessary and leaving a round corner, will add to the strength of the joint while making this flat slightly tapered will facilitate the driving and insure a tight fit.

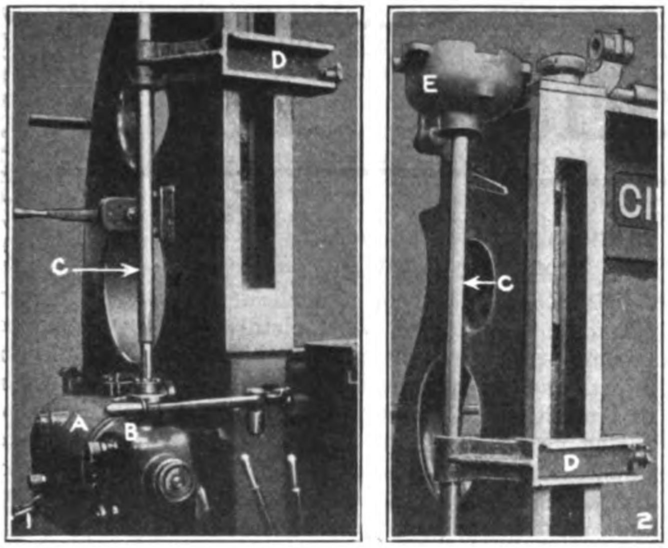
An Aligning Fixture That Aids in Assembling

By J. Bainter

Assembling operations on large machines can be greatly facilitated by the use of fixtures for properly holding parts while mounting them. Among a number of such fixtures employed in the plant of the Cincinnati Planer Co. at Oakley, Cincinnati, Ohio, one little device used in aligning the vertical feed shaft on a boring mill is worthy of note.

The parts of the feed mechanism of the 42-in. boring mill shown in Fig. 1 are assembled in the following manner. The feed box *A*, which has been previously assembled as a unit, is put on the side of the housing in the usual manner on the pad provided for it. Then, the reverse box *B*, in which are the gears for reversing the direction of the feed, is doweled in place. The reverse box is located at its proper distance from the finished surface of the housing by means of a special gage that can be employed for all sizes of machines. A straightedge is first laid on the finished surface of the housing, and a mandrel is placed in the large hole at the top of the box. Then, by using the gage, the proper position of the box can be easily determined.

The vertical feed shaft *C* is now put in place. In



FIGS. 1 AND 2—ALIGNING FIXTURE HOLDING VERTICAL FEED SHAFT IN PLACE WHILE ASSEMBLING

order to hold it in the correct position so that the top of it will be in proper alignment, the fixture *D* is clamped on the housing of the machine. With the fixture holding the shaft in place, the rapid traverse bracket *E*, see Fig. 2, at the top of the housing is doweled in place. This bracket contains the bevel gears used in driving the horizontal shaft at the top of the machine for the rapid traverse. The gears are put in place with the aligning fixture still mounted on the housing. Although the fixture is rather small and seems insignificant, its use enables very much more rapid assembling than is possible without it.

Limitation of Piston-Aligning Gages

By J. T. Towlson

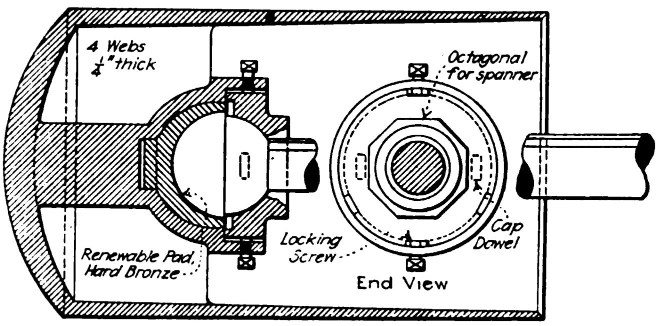
London, England

Piston-aligning gages are as common as dust in March, as are also the innumerable appliances for securing accurate 90-deg. fitting of the piston pin. Notwithstanding the truth of the above, one unfamiliar with details would be surprised to witness the amount of touching up, padding, and bedding in of the contiguous parts of piston accessories on the assembly bench. Why is this the case? I believe there is a reasonable answer.

Take, for example, the piston-aligning gage shown in the Shop Equipment News of the *American Machinist*, on page 982, Vol. 56. This gage will show only whether the piston lies at 90 deg. with the big end bore of the piston rod. Its limitation is that it will not show whether the tested part of the piston is the correct distance from the face of the big end of the rod. This test might easily have been made, if the gage had been provided with a micrometrically graduated collar fitting on a threaded part of the arbor. If the two faces of the big end of the rod are intended to be the same distance from the piston diameter, nothing is more simple than to test one side of the piston with the one face at the big end of the rod touching the face of the collar, and then to turn the piston rod round 180 deg. and try it again. Should the faces of rod and piston not simultaneously touch the straight edge and the graduated collar, the detail either becomes a reject or must be dealt with by the assemblies.

Mechanics accustomed to motor-engine building will readily agree that accurate jigging of a member will guarantee that such part is passable by the inspector. They will further agree that such jigging of one part only does not fill the bill. Other parts, of which the jigged part forms but a detail, unless jigged too, may be out of accuracy and, if so, one of the parts will require "facing to make it fit in." This is the cause of the congestion of work at the assembler's bench. Much more could be written in support of the above but limitation of space forbids. Just to complete the article as briefly as possible, a few remarks will be made with reference to the dispensability of piston aligning gages. Methods, designs and contrivances, religously believed to be indispensable today, will be obsolete and altogether dispensable tomorrow, while devices we believe to be new and original, or operations we believe to be impossible to perform, have probably been in constant use and practice for a long time in other shops. To come closer down to the concrete, is the common gudgeon pin, as applied to every internal combustion engine, indispensable? Is it the best device for the purpose of taking the explosive thrust of the piston and conveying it to the crank of the journal? Personally, I do not think it is.

In the first case, it is a most untractable member of the engine's make-up. It is a law unto itself and all parts must give way to it. No end of money has been expended on jigs and fixtures as a means of guaranteeing the necessary 90 deg. off the piston's geometrical center, and yet, notwithstanding such cost for tools, the smallest hard spot in the cast iron surrounding the hole will undo all the good provided by the expensive tools.



PISTON AND ROD WITH BALL JOINTS

In the second case, "the nicest affairs of mice and men oft gang aglee" and frequently well fitted gudgeon pins have got loose, moved end-wise, and badly score the cylinder. My idea is to knock out the troubles arising from intractability and abrasive danger by a change in design. I suggest a piston rod with a ball end as a substitute for the common wristpin. The sketch herewith shows the idea.

Such a device is tractable and yet, while able to perform its proper task of driving the crank quite as well as the gudgeon pin, it possesses none of its faults. No piston-aligning gage will be required and no more money expended on expensive jigs and fixtures for boring the gudgeon hole truly and no more occasion to leave $\frac{1}{16}$ in. or $\frac{1}{8}$ in. between the sides of the big end of the rod and the crank cheeks, as is often done. With the ball end the rod is tractable in all directions, while it also allows the piston to creep around in its cylinder, creating a glassy bore in the cylinder.

Editorial

ONLY one man ever stopped the sun and moon in their courses—and he had divine assistance. As well try to stop human progress and yet men have tried. They have spent valuable time in careful study of some form of human endeavor and have said, "This is the way to do the job, this and no other." But almost before they have said it somebody has found a better way and their words were wasted. Engineers, wise in industrial ways, have established standards with provisions for change as knowledge broadens and skill increases.

"Where do we go from here?" is a better slogan than "Here we are."

An American Counterpart of the East Indian Magician

THE MAGICIANS of India have long been noted for their ability to make a plant grow from the seed and flower before the eyes of the astonished observer. Just how this is done we do not pretend to know but it is no more wonderful than the deeds expected of American machine tool builders. Of course machine tools differ from the bush of the Indian magician in that they are made by men and by processes that are familiar and readily comprehensible. Nevertheless the time required to complete the modern planer or boring mill is not far different from that required for the maturing of many flowering plants.

The prolonged business depression and the consequent habit of buying for immediate needs only is probably responsible for the cautious attitude of purchasers of machinery of all kinds. It is no excuse however for the demand of the customer for delivery of complicated machinery in an impossibly short space of time. Almost every statistical service has been warning the business men and manufacturers of the country for months that the rising wave of prosperity would mean rising costs of equipment and difficulty in obtaining deliveries but in the face of these warnings the purchasers have delayed and procrastinated in the placing of orders which might well have been signed weeks or months ago. They are now feeling the pinch of demands which cannot be filled. Hand to mouth methods may be very well in a falling market or in a time when money is tight, but under present conditions there is no excuse for them. Instead of saving money they mean greater expenditure in the long run. Rush work and overtime are expensive luxuries.

At the recent convention of the American Gear Manufacturers' Association, one of the most progressive members of that body announced that he was rapidly getting in shape for the business he expected to get during five years of prosperity. Additional machinery has been purchased and more is on order and, as a consequence, his shop is in the pink of condition to accept the increasing business that is being offered. If all machinery users were as wise and aggressive as this man, the situation of the machinery builders and of the country in general would be far better than it now is and the next depression would be farther off.

Is Industrial Development Necessarily Ugly?

THERE IS A school of modern writers who delight in painting lurid word pictures of the filth and gloom surrounding the modern industrial plant. Their efforts have been so successful that the average reader of American magazines is convinced that all manufacturing plants, especially those in the metal trades, are unpleasant, demoralizing places in which to work. Unfortunately the descriptions are no exaggeration of the conditions existing in many shops.

On the other hand, we know of not a few machine shops that are kept as clean as a New England housewife's kitchen, shops that are pleasant to visit and pleasanter to work in, for the cleanliness is but an outward manifestation of the sound management within. The names of some of these shops will be found on our advertising pages, have been there for years, in fact. Their honorable and prosperous history is sufficient evidence that machine shops are not necessarily ugly and that clean, pleasant surroundings are an incentive to the men enjoying them to take pride in themselves, their work and their company. A liberal use of paint, soap, water, and elbow-grease goes far to raise the tone of any shop and brings returns, intangible though some of them may be, far in excess of the outlay.

Four Miles a Minute

THOSE who are interested in the progress of aviation, and that includes nearly everybody, cannot but rejoice at the strides which have been made in the past few months. Lieut. Doolittle's one-stop flight from coast to coast, Macready and Kelly's thirty-five hours in the air, and now the new records for speed by the planes entered by the army in the meet at Detroit are all notable. Averaging 206 miles per hour over a 156-mile course with several turns sets an entirely new mark for human travel. Approximately three and one-half miles per minute or over 300 feet per second, comes the nearest to annihilating space of anything yet accomplished. And even this was eclipsed in a straightaway flight at the rate of 248 miles per hour, or over 4 miles a minute.

We cannot overlook the fact that this great achievement is due primarily to that pioneer of practical aviation, Glenn H. Curtiss, for, without in any way detracting from the discoveries and achievements of the Wright brothers and others, it was Glenn Curtiss who won the first aircraft prize for a mile race in 1908 and a year later at Rheims brought home the Gordon Bennett trophy by flying 12.42 miles in 15 minutes, 56½ seconds. Curtiss also made the spectacular flight of 142 miles from Albany to New York so early in the game that it was necessary to stop three times for fuel and oil.

As if to crown his achievements, although he is still a young man, both the army planes which outdistanced everything in the air, are a result of the experience of Glenn Curtiss and his organization. They were not

only Curtiss planes with his designs of radiators built into the wings, but Curtiss motors as well. It is not often that a pioneer is able to keep pace with the development of a new industry in such a way and it is gratifying to see one who has been able to keep abreast of the times in such a rapidly developing science.

The pilots too, must not be overlooked. Without them the best planes in the world are of little value. The consistent performance of the two ships is noteworthy and gratifying. The winner, Lieut. R. C. Maughan averaged 206 miles an hour while Lieut. L. J. Maitland averaged 203, although one lap of the latter's flight was negotiated at the rate of 216.1 miles per hour. Maitland's power gasoline pump failed after the first lap and he drove the remaining distance by handling the ship with his right hand and pumping gasoline with his left. And a 375-hp. motor is hungry for gas all the time. Maughan was also under a heavy mental strain all through the race and both pilots deserve great credit for their performance.

From 49 miles an hour in 1909 to 248 miles an hour in 1922 is remarkable progress. Moreover, when we consider that the planes which accomplished both feats are from the hands of the same designer, we are impressed both with the short time required for aircraft development and the way in which a pioneer has kept not only abreast, but in advance of the times.

The Growth in the Use of Grinding Machines

THE USE of grinding machines has become so common in almost every line of machine production that we are apt to forget how young the process is as a real manufacturing possibility. It does not require a Methuselah in the machine industry to remember when grinding was an extra operation, used only on hardened surfaces, to correct the distortion due to heat treatment. It was a slow process too, removing a very small amount of metal and doing little more than making sparks and imparting a more or less smooth finish.

The development of better grinding wheels, better machines and the experience gained in the use of both has brought grinding into a very prominent position as a means of finishing either cylindrical or flat surfaces. Instead of being an additional operation, it now merely replaces finish turning, boring or planing and, in some instances, also eliminates the roughing out as well, as in the case of crankshafts. Many varieties of surfacing work are now done on disk grinding machines or machines using ring grinding wheels and at an astonishing rate. Much of this work was considered outside of the grinding field but a few years ago.

Among the newer developments in grinding are centerless grinding, form grinding and the removal of heavy cuts by surface grinding. These are three phases which men responsible for economical production will do well to study carefully. They seem destined to play an important role in the reduction of machinery costs.

The almost unbelievable results obtained with modern grinding wheels, the small amount of wear which enables form grinding to be done with unusual accuracy and the growing belief that even greater developments are under way, make it imperative that we study the possibilities of grinding even more closely than in the past. In too many cases, when grinding has not proved entirely successful, the fault lay with the machines or methods employed rather than with the process itself. Properly designed spindles in suitable bearings, in which both temperature and lubrication are considered, are essential to success. Correct wheels, feeds and speeds also are necessary. It is very easy to make a mistake as to what is right without a wide experience in similar work.

While grinding will not supersede all other methods of machining, it is likely to make still further changes in our methods of production. It is invading new fields and will continue to do so as we learn more about it. The production man who does not study grinding because of failures in the past, is sure to fall behind. Later knowledge, and the experience of others who have succeeded, should be earnestly sought after and applied. It is a study which will pay big dividends.

When Should Machine Tools Be Replaced?

THE QUESTION as to when a machine tool should be replaced is not often considered in a methodical way. Instead it seems to be taken for granted than one may let "nature take its course." If the machine has become unfit for further work there will certainly be somebody to notice it and demand will then be made for a new one.

In shops where machine tools are the chief means of production, such hap-hazard methods, or rather lack of methods, should not be tolerated. Instead, a deliberate attempt should be made to find out beforehand at what age a machine should be replaced. We are not referring to the substitution of a different kind of machine, or even of an improved tool, but simply to the degree of fitness left after a number of years of service.

It needs very little argument to show that neither should a machine be kept after it has passed its hundredth birthday, nor should it be discarded after a year's service. It is very evident that the point of greatest total economy lies somewhere between these extremes. This point may be different for various classes of machines, even for different makes of the same class, and further, it may be different for identical machines, used in different shops or for different purposes in the same shop. But, and this is the point, the economical life of every machine should be known, not to a day but accurately enough to make it the basis for action. It is a safe guess that, if this were done there would be replaced many machines which now lead the lives of invalids, pampered and doctored and demanding new expenses for repairs besides reducing and interrupting production.

Just Suppose

SUPPOSE you were proprietor of a shop with, say, a hundred men, and suppose these men felt that they had not been doing as much work as would have been possible. Suppose they speeded up, and studied their work, and co-operated and burned the midnight oil, just to increase production and to have the satisfaction of having fully earned their wages. Just suppose they did. Would you say to them:

"Why boys, this will never do. You are turning out more than twice as much work as I expected, and all for the same wages. No, really, this is not fair. I will have to double your wages, and maybe more."

Would you say this?

Oh, well! What is the use of asking foolish questions? But—

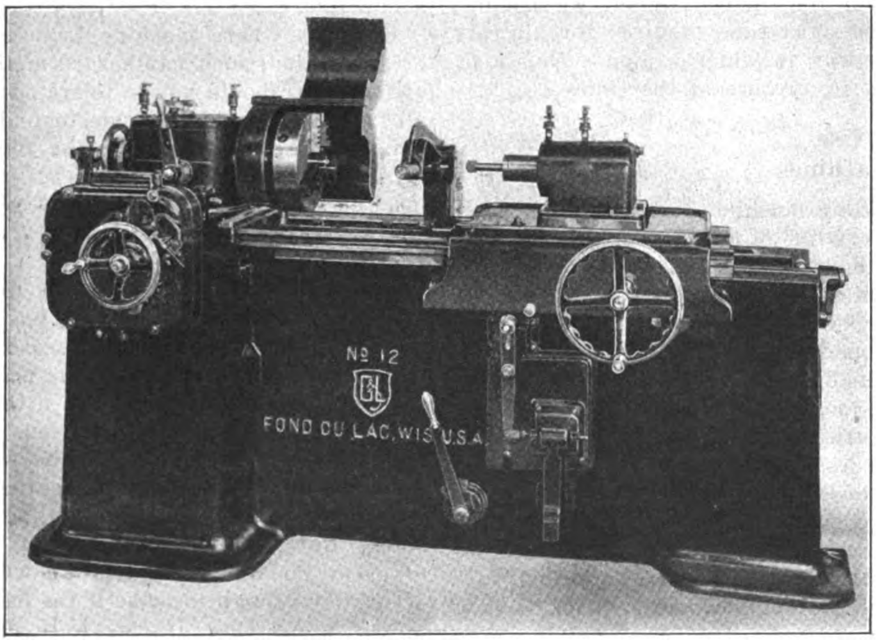
Just suppose.

Shop Equipment News

Giddings & Lewis Automatic Internal Grinding Machine No. 12

A grinding machine that is intended to perform automatically internal grinding operations on parts such as employed for automobiles and machine tools, so as to eliminate hand plugging by the operator, has recently been developed by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. A much lower degree of skill is required of the operator than is usual for internal grinding operations, as the machine itself grinds holes to a finished size with but slight attention from the operator.

The feature of the machine that enables its operation is an automatic gaging mechanism incorporated and correlated with the driving and feeding mechanisms. After the operator chucks the piece and starts the feed, the machine will grind to the finished size, automatically trip the carriage feed, and return the carriage to the rest position. Means is provided to care for wear of the wheel. The exact action of the gaging device will be described later in connection with the feeds of the machine. The bar gages used on the machine have a much lower cost than plug gages and their life is greatly prolonged because of the fact that they revolve at the same speed as the work and the mechanism employed for entering the gages in the work reduces wear to a minimum.



GIDDINGS & LEWIS AUTOMATIC INTERNAL GRINDING MACHINE NO. 12

The No. 12 machine, a front view of which is shown in the accompanying illustration, grinds holes from ¾ to 10 in. in diameter and up to 9 in. in depth. The total swing over the ways is 13 in., and the height of the spindle from the floor 44 in. The machine is motor driven and entirely self-contained, being equipped with push-button control. The motor is mounted on the back of the bed, which is of substantial construction and well ribbed to provide strength and rigidity. All parts of the machine having bearing surfaces are protected from dirt and abrasive material. The entire construction of the machine is rugged, so that continuous production should be obtainable.

The work head is mounted at the left of the machine on a circular bearing fitted to a cross-slide. Means of indexing the head quickly and accurately are provided, and tapers can be ground to an included angle of 30 deg. The work spindle runs in bronze bearings and is provided with six speeds. The speeds can be selected by turning the handwheel on top of the work head to any of the six indicated positions. Ball bearings are provided in the power transmission line from the motor to the spindle.

The drawbar for operating collet chucks is operated by a handwheel at the rear of the work head. A special three-jaw gear scroll chuck made by the Cushman Chuck Co., Hartford, Conn., is furnished as standard equipment. The chuck has a holding capacity of ¼ to 10¾ in. It is watertight and all parts are protected against grit. The body, which is filled with grease, is made of steel with all working parts hardened. The wheel carriage is of heavy construction, has large bearing surfaces on the ways of the bed and is guided by means of V's on both sides. The carriage is reciprocated hydraulically. and the motor for driving the wheel spindle is mounted directly beneath the spindle and on the carriage, reciprocating with it, so that the life of the high-speed driving belt should be greatly prolonged. The wheel heads are tapered on the outside and are mounted in a corresponding taper in the wheel head housing and fastened in place by a locknut. In this way spindles can be easily mounted and removed. Each spindle runs in ball bearings in its own wheel head and separate steel pulleys are furnished with each spindle so that the correct wheel speed can be obtained.

The work is fed against the wheel at each end of the stroke, and two separate series of feeds are provided, ten for roughing and five for finishing. The carriage has a maximum travel of 20 in. and is provided with six traversing speeds.

Both sets of feeds are controlled by the use of two gages, a roughing gage and a finishing gage. In grinding the hole, when it reaches the size where the roughing gage can enter the work, the roughing feed is automatically disengaged. The finish feed automatically engages until the finishing gage can enter the

work, at which time the trip on the carriage automatically operates and returns the carriage to its rest position.

Coolant is handled by a directly driven centrifugal pump mounted within the machine, so as to force the lubricant through the center of the work spindle and on to the work. Means are provided for automatically cutting off the water supply when the wheel leaves the work and also for turning it on again when the wheel enters it.

The standard machine is motor driven by either a.c. or d.c. current. It requires a floor space of 7 ft. x 4 ft. 2 in. and weighs net 4,400 pounds.

Bausch High-Speed Multiple-Spindle Drilling Machine No. 2A

In order to apply the feed pressure directly over the center of the drilling area when a gang of drills is being used in one head, the center feed arrangement shown on the No. 2A drilling machine in the accompanying illustrations has recently been developed by the Bausch Machine Tool Co., Springfield, Mass. The construction maintains true alignment of the spindles and prevents the head from springing under the drilling pressure so that the drills do not align correctly with the bushings. Thus, the friction on the drills is decreased and the strain on the feed mechanism greatly reduced. Cramping on the ways is largely eliminated.

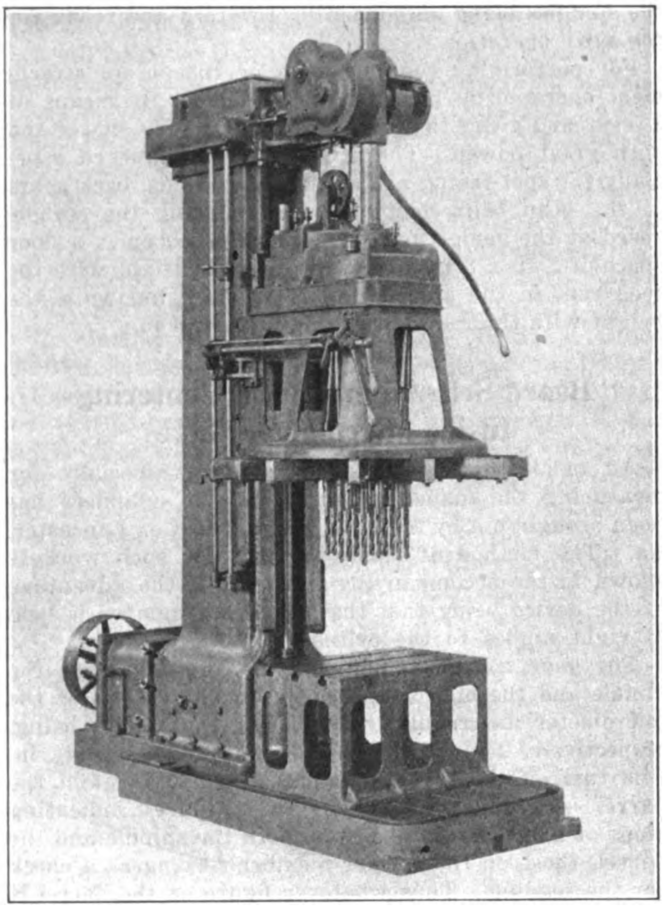
Heads of various sizes, both round and rectangular in shape, can be furnished. The head is of the type ordinarily employed on Bausch multiple-spindle drilling machines. It provides large vertical adjustment of the individual spindles and allows a minimum center distance to be obtained equal to the diameter of the spindles themselves. The head is provided with an automatic counterweight catch which prevents it from falling in case of accident to the cable.

The machine has a capacity in cast iron of twelve 1-in. drills, or the equivalent. Owing to the center feed construction, the distance from the center of the head to the face of the post is made greater than when the feed pressure is directly from the post, being 20 in. in this case. The width of the face of the post is 12½ in., and on it the head has a traverse of 25 in., the least distance from the spindle to the bed being 20 in. and the greatest distance 45 in. The bed is provided with T-slots and box or rotating tables can be furnished to suit the work to be done.

Four different methods of drive can be furnished, the first by means of a three-speed cone pulley, the second by a three-speed change-gear box motor-driven, the third by a three-speed change-gear box belt-driven, and the fourth by a direct-connected variable-speed motor. The main drive comes from the base of the machine directly to the head gears, so that the mechanism is simple. As illustrated, the machine is driven by a 5½-in. belt on an 18-in. pulley. Fifteen to 20 hp. are required for the operation.

The feed is accomplished by means of a heavy ram placed directly above the center of the drilling area. This ram is moved by a pinion which is connected through the change-feed gear box directly to the main drive of the machine. For each change of speed, of which there are three, there are three changs of feed, which vary according to different combinations from 0.0018 and 0.023 in. per revolution of the spindle. These speeds are standard, but feeds either faster or slower can be provided to suit special requirements. The head is operated by hand only when counterboring or in an emergency, or when adjusting the tools for height and alignment in the jigs. The pilot wheel for hand feeding is consequently located rather unobtrusively and is disconnected when not in use. In the illustration it cannot be seen as it is on the right side of the frame.

Roller bearings are used for shafts and ball thrust bearings wherever required. All driving gears are of



BAUSCH MULTIPLE-SPINDLE DRILLING MACHINE

steel. The column has a hole in the back so that small weights can be added or removed to properly adjust the balance of the head. An oil pump and oil tubes can be furnished, so that coolant can be employed. The grooves in the bed collect the coolant and supply it to the reservoir in the base.

The ease of operation of the machine is the feature to which the maker calls especial attention. The quick approach and return of the head is operated by means of friction clutches in the feed gear box, so that the operator can by means of a conveniently located lever raise or lower the head at a fast speed. The head can come down at this fast speed until the drills actually touch the work, no care being necessary to prevent damage, since the friction clutch immediately slips when the drills strike the work. The power feed is then engaged, and upon completion of the drilling operation the head automatically returns at fast speed and stops at the starting position. This quick approach and return feature is not an attachment, but is built integrally in the machine.

The machine can be built for tapping in addition to drilling. In the tapping model, back gears on the head

are employed for reducing the spindle speed, these gears being engaged or disengaged while the machine is running, if desired. When performing a tapping operation, the operator first brings the taps down into the work by means of the quick approach. Further downward movement of the head is then controlled by the lead of the taps in the work. At a certain point, the direction of rotation of the taps is automatically reversed. After the taps have cleared themselves from the work, the operator engages the quick return and the head travels quickly to the starting position and stops, the spindles being automatically reversed and ready for the next operation.

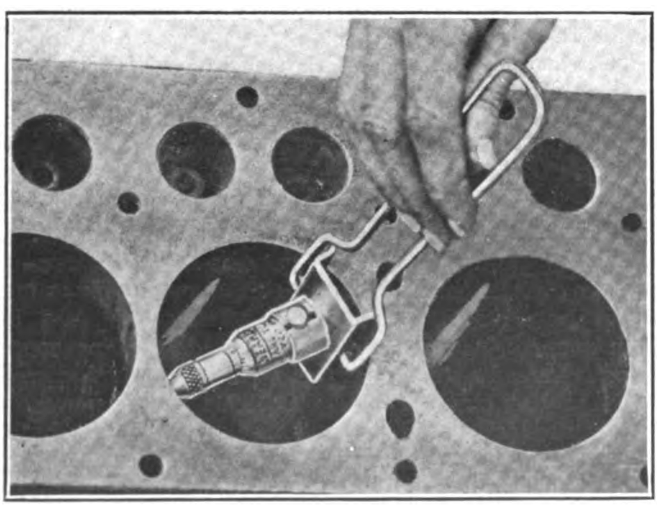
For performing counterboring operations an attachment operated by hand can be supplied. By means of a lever and gears the head is advanced very slowly and with great power. The attachment is employed especially for spot-facing and similar operations, back gears in the head being employed for reducing the spindle speed at the same time. The machine occupies a floor space of 3 ft. x 8 ft. 10 in., its extreme height with the feed ram in the up position is 12 ft. 3 in., while the height with the ram down is only 10 ft. 8 in.

Beard Self-Aligning and Centering Inside Micrometer Gage

An inside micrometer gage intended especially for measuring the diameters of automotive cylinders has been brought out by the L. O. Beard Tool Co., Lancaster, Pa. The method of using the tool for such work is shown in the accompanying illustration, the advantage of the device being that the measuring number is held at right angles to the cylinder walls.

The gage consists chiefly of the aligning base, the handle and the micrometer proper. Three sizes of the micrometer are regularly furnished, the ranges being, respectively, 2½ to 3 in., 3 to 3¾ in., and 3¾ to 4½ in. One turn of the screw advances it 0.050 in., and the barrel is graduated to 0.001 in. Figures indicating steps of 0.005 in. are placed on both the spindle and the barrel, those on the former member serving as a check for the reading. Thus whatever figure on the barrel is found opposite the zero on the spindle, will also be found on the spindle opposite the zero on the barrel. Both ends of the micrometer and the parallel edges of the base are hardened and ground.

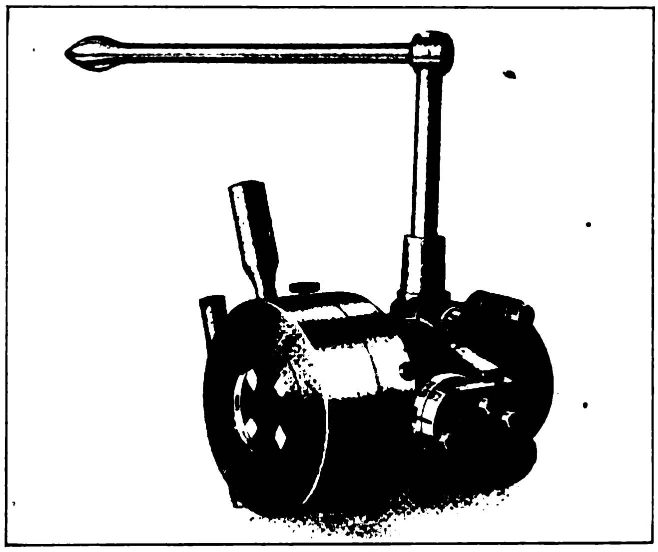
When in use the micrometer is placed in the bushing of the aligning base, in which it is a sliding fit. A ring can then be placed on the rear end of the barrel to keep the base from falling off. The tool is inserted in the bore to be measured, the base pressed against this bore, and the spindle screwed out until both it and the barrel end touch the bore. The base holds the tool in the proper position for obtaining the exact diameter of the cylinder, as the micrometer is both centered in the bore and perpendicular to the axis. The micrometer is then locked by means of the setscrew to preserve the reading, and the aligning base slid forward on the barrel so that the tool can be titled and removed from the cylinder for reading.



BEARD INSIDE MICROMETER GAGE

Hartness Taper Threading Die

The Jones & Lamson Machine Co., Die Division, Springfied, Vt., has placed on the market a new design of its self-opening die for the cutting of threads of any taper from zero, as on cylindrical work, up to 2 in. taper per foot. Set for the maximum taper the die will cut threads 1⅝ in. long, and proportionately longer as the angle approaches the minimum. It is especially adapted to the cutting of staybolt threads and may be used in tandem with another die in the rear for cutting the parallel-sided portion of the thread.



HARTNESS TAPER THREADING DIE

As shown in the illustration the die is open to its fullest extent and the former-pin is out of the guiding slot. To set it in closed position for beginning a thread the operator pushes forward the short handle on the die sleeve until the former pin is brought into the slot in the adjustable former, and then he withdraws the die to its extreme position by moving the pinion lever at the top.

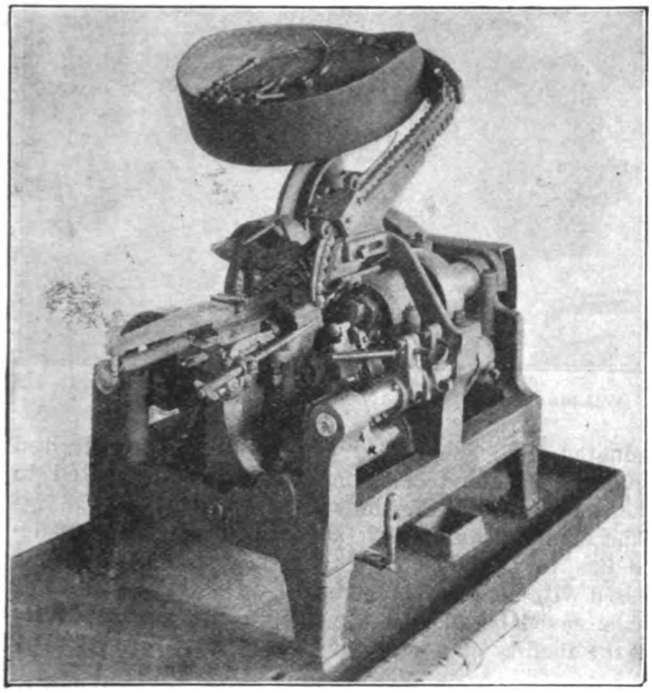
The die holder as furnished is intended to be bored in position in the machine with which it is to be used, thus bringing the tool into perfect alignment with the work spindle. The bushing in which the operating pinion has its bearing is eccentric, so that the pinion may be adjusted by a partial rotation of the bushing to compensate for any inaccuracy of alignment that may be manifest in the machine. Minor adjustments for diameter are accomplished by turning the knurled-head adjusting screw in the usual way.

The tool is made in two sizes. The No. 3 size will cut threads 1¼ in. in diameter at the large end, and the No. 6, threads up to 2 in. in diameter.

Cook Bolt and Capscrew Shaving Machine

The Asa S. Cook Co., Hartford, Conn., has recently placed on the market a new design of its bolt and cap-screw head shaving machine. A single belt from the lineshaft drives a countershaft under the pan of the machine and from this countershaft all movements are derived, thus permitting the setting of a row of machines under and parallel to the lineshaft with just sufficient room between each machine to clear the belt.

Separate carriers are provided for the tools, one of which faces the shoulder under the head of the bolt or screw while the other is rounding or otherwise forming the end of the head, the cuts being taken simultaneously. These carriers are given a swinging movement about axes that are set at a slight angle to the center line of



BOLT AND CAP-SCREW SHAVING MACHINE

the machine, so that as the tools advance to the work they also draw slightly nearer together. This movement has the effect of clearing the tools immediately upon the finish of the cut and allowing them to withdraw without dragging. The carriers are independently adjustable.

The gripping device that catches each screw as it falls from the feed race has also been improved, gripping the screw by the shank end and steadyresting it as near to the head as possible without interfering with the shouldering tool, thus giving each piece a firm support close to the cut.

The hopper on this machine is constructed upon an entirely different principle than formerly employed. Instead of the usual revolving hopper this one is stationary and is supported by a hollow bracket, the upper end of which forms a bearing for a revolving shaft. To this shaft, at the point where it extends through the base of the hopper, there is keyed a four-armed spider —or "agitator," as it is called—which is caused to revolve slowly and keep the contained mass of bolts or screws constantly stirred up, so that an annular groove close to the side walls of the hopper is kept filled with the work. In the illustration all those bolts that may be seen lying close to, and as nearly as possible parallel with, the side walls are in this groove.

At the bottom of the groove is an annular ring, the upper surface of which is roughly serrated, and this ring is slowly and continuously revolved in conjunction with the agitator. The result of this combined movement is that the outer circle of bolts in the hopper is continuously moving forward toward the high side of the base, at which point the bolts are discharged into the feed race. It matters not which end of the bolt or screw is presented to the feed race, for as soon as a bolt enters the latter the shank end swings downward by gravity and the bolt is thenceforward supported only by the shoulder under the head.

It will be noted that the feed is at all times caused by the friction of the bolts lying upon the serrated surface of the moving ring (the arms of the agitator do not extend over the groove), so that there is no positive impulse and consequently no possibility of jamming. The rate of travel of the ring and agitator is very slow as compared with the movements of the machine, and may be varied by using different combinations of driving gears so as to keep the feed race full of work at all times.

The number of bolts in the hopper does not affect the feed, as the latter will completely empty the hopper and carry forward the last bolt as readily as the first one without hesitation or interuption. The duty of the hopper ends with the delivery of the work to the feed race; from that point forward the feed is by gravity only and the machine will continue to function until the race is exhausted.

The manufacturer is redesigning the entire line of bolt and screw machinery, which includes shavers, pointers, and die-threaders, and will equip all such machines with this type of hopper. The machine here shown handles bolts or cap-screws up to ½ in. in diameter by 4 in. long. Larger sizes are under contemplation.

Victor Receding-Chaser Collapsible Pipe Taps

The receding-chaser collapsible pipe tap made by the Victor Tool Co., Waynesboro, Pa., has recently been redesigned and improved. The basic principle of the design, such as described on page 915, Vol. 51 of *American Machinist* has not been changed, although the details have been altered somewhat.

Instead of using the ordinary tapered chasers for cutting a standard Briggs tapered pipe thread, and depending upon the length of the chaser to give the

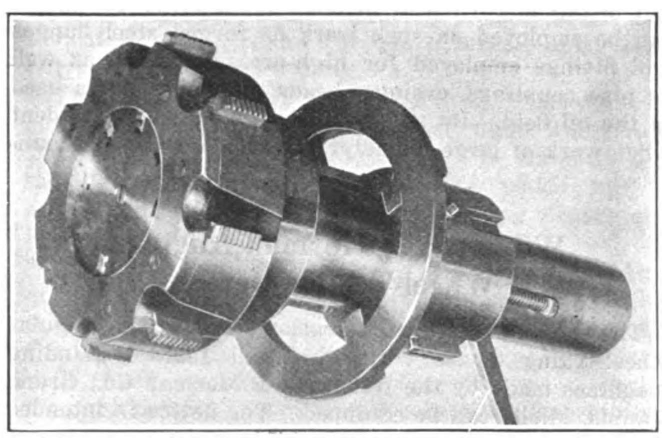


FIG. 1—VICTOR STATIONARY-TYPE COLLAPSIBLE PIPE TAP

proper length of the thread, short chasers are employed and are made to recede as the tap enters the work. A trip collar is set against the face of the work when the operation is started, and as the tap feeds in, it pushes back on the cam collar that controls the receding of the plunger on which the chasers are mounted.

The view in Fig. 1, which shows a stationary lever-operated type of pipe tap, illustrates the arrangement of the collar. Although formerly only one cam block was used, two blocks working in conjunction are now

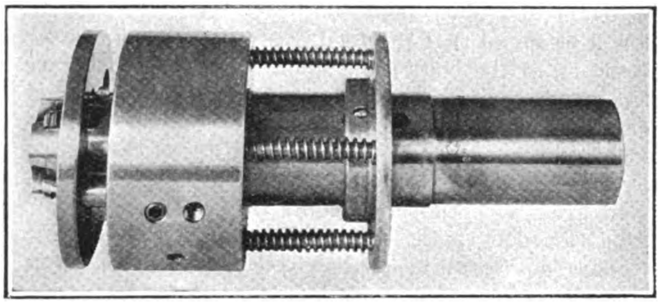


FIG. 2—VICTOR ROTARY COLLAPSIBLE PIPE TAP

employed so that the receding of the chasers is more positively controlled to give a more uniformly tapered thread. A tapered thread can be cut off at any length desired and have the taper uniform throughout its entire length. The design of the cam blocks has also been altered to make them more effective and positive.

A rotary type of collapsible tap, such as shown in Fig. 2, has also been altered in design. Instead of a detachable lever for setting the collars and chasers in position for cutting, a ring or collar has been substituted. Pressing forward on this collar by hand, or by means of an attachment on the tapping machine that comes in contact with the collar when the spindle is raised, the chasers can be set without stopping the machine. There are no projections from the cylindrical form of the tap, so as to safeguard the operator.

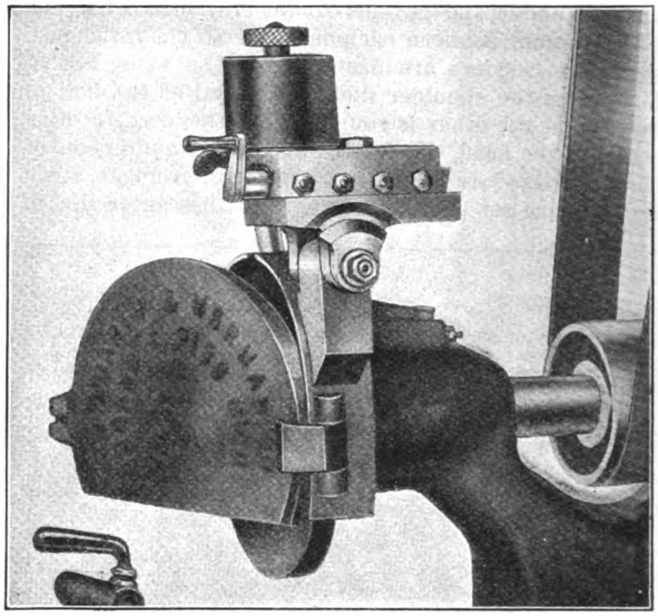
In both styles of the tap, means of adjusting the size with a range of $\frac{1}{16}$ in.. either over or under the size are provided. Adjustment of the trip collar permits cutting any length of thread desired. The tap requires from one third to one half less power to drive than the ordinary tapered thread tap, it is claimed, because unnecessary bearing has been eliminated by the use of the short chasers and a tapered thread is cut in virtually the same manner as a straight thread. Interrupted thread chasers are used when tapping steel.

The tap is furnished in sizes from $1\frac{1}{4}$ to 12 in. It can be employed on such work as forged steel flanges and fittings employed for high-pressure work, as well as pipe couplings, casings, heads and other parts used in the oil field. Its adaptability is particularly evident when work of large diameter or extra length is encountered.

Wilmarth & Morman Angular Wheel-Truing Device

The accompanying illustration shows the angular wheel-truing device with which all surface grinding machines made by the Wilmarth & Morman Co., Grand Rapids, Mich., can be equipped. The device is intended for use in shops salvaging and reclaiming worn-out milling machine cutters, reamers and drills, as well as those making a specialty of cast stellite cutters and tools. By the use of this device, the wheel can be easily formed to correspond to the outline to be ground.

The illustration shows the wheel-truing device in position for dressing the wheel face parallel with the table. The diamond is fed to the wheel by means of the knurled knob at the top, while the crank is employed to feed the diamond across the face of the wheel. By means of the



WILMARTH & MORMAN WHEEL-TRUING DEVICE

graduated dial, the device can be set at the desired angle, the diamond carrying member being tilted to either side for dressing the wheel face at an angle.

The chief advantage of the built-in wheel-truing device lies in the fact that the wheel can be properly dressed without disturbing the set-up of the work. Time can be saved because of the adaptability of the device and the facility of operation.

Kingsbury Automatic Horizontal Sensitive Drilling Machine

The Kingsbury Manufacturing Co., Keene, N. H., has made further developments in its line of automatic sensitive ball-bearing drilling machines. The recent or No. 8 machine embodies a fully automatic feed and control very similar to that employed on the machines described on page 1066, Vol. 53, and on page 1060, Vol. 54, of *American Machinist*. Although these latter machines have vertical spindles, the No. 8 drilling head shown in Fig. 1 is ordinarily operated with the spindle horizontal. The principal difference between the recent model of the device and the No. 1 machine previously described is that a cam has been embodied in the spindle controlling mechanism so that difficult drilling jobs can be more effectively handled.

The No. 8 drilling head has a capacity for drills from No. 60 to $\frac{1}{4}$ in. in diameter. Its operation is as simple as that of a power punch press, as the operator merely places the work in position, clamps it, and then presses the trip lever. There are seven ball bearings employed on the machine, so that friction is reduced as much as possible to make the machine sensitive. The worm employed in the mechanism is of hardened steel, and the gear of phosphor bronze.

An automatically controlled pressure feed system is

employed for the purpose of eliminating drill breakage. The action occurs through the cam and the friction rolls or gears seen on the side of the device. The driven gear is mounted on a lever held in mesh with the friction driving roll or gear by an adjustable compression spring. The cam is cut on the inside of this driven gear. The follower roller is mounted on a gear segment which meshes with a gear segment clamped to the feed shaft. The arrangement is such that the cam

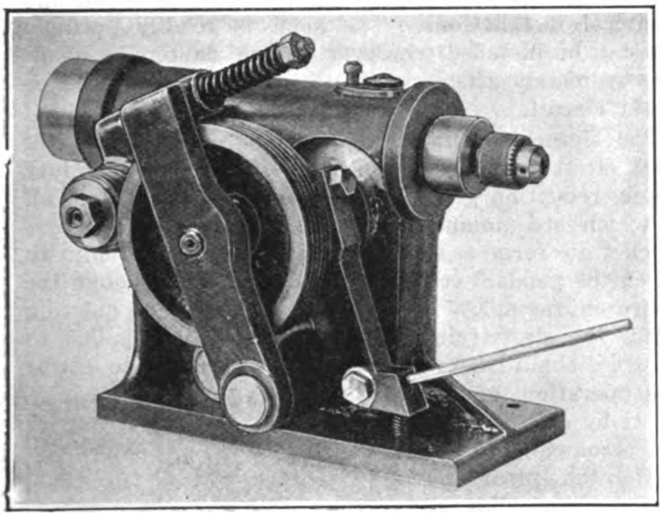


FIG. 1—KINGSBURY NO. 8 AUTOMATIC DRILLING HEAD

is revolved by the friction gears and feeds the spindle forward.

When the forward motion is resisted, as when the drill strikes the work, the follower roller is held momentarily and the rotation of the gears causes the cam to climb on the roller, thereby separating the friction gears, and permitting slippage. As the drill penetrates the work under pressure, the follower gives way,

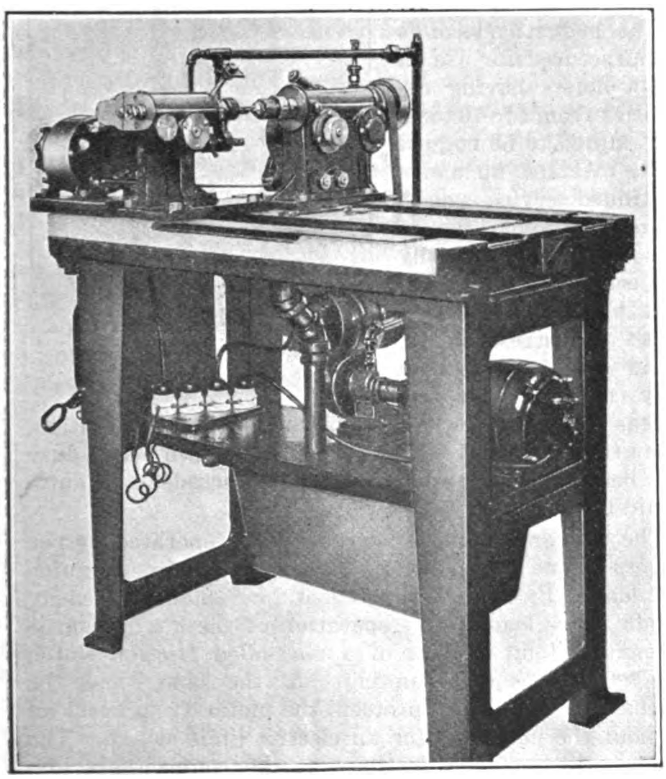


FIG. 2—KINGSBURY AUTOMATIC SENSITIVE DRILLING MACHINE

bringing the friction gears into contact again and causing the cam to revolve and again to separate the gears when further resistance is met. The motion is claimed to be so smooth and rapid that it cannot be detected as intermittent.

The standard cam employed gives a stroke of 1 in. to the spindle with a maximum feed of 0.011 in. per revolution. Thus the drill approaches the work and breaks through at a comparatively rapid rate, while the actual drilling feed depends on the pressure adjustment, the hardness of the work and the condition of the drill. Special cams can be used with one or two reliefs to permit of withdrawing the drill during the operation, so as to relieve the chips. The spindle has a total adjustment of 2 in. besides the 1 in. travel. It can rotate at speeds as high as 4,000 r.p.m.

The head can be driven by either a countershaft or motor, ¼ hp. being usually required. The spindle is 6¾ in. above the base, and the overall height of the machine is 9½ in. The length of the head when the chuck is in the back position is 14 in. The width is 7 in. and the net weight 50 pounds.

The head can be well employed in multiple for performing the same operation on several parts, or for performing different operations on the same part. In this way a semi-automatic machine for large production, such as when drilling oil holes, is formed. Fig. 2 shows a floor type of machine intended for cross drilling and burring chuck wrenches. The machine is equipped with a single No. 8 head, and with a special fixture which automatically clamps each wrench and then removes the burr from the work.

As many as four of these units can be mounted on the table if the production desired warrants this number. Thus one operator could care for all of them and the work could be progressing simultaneously in each. It will be noted that three small motors are employed, one for driving the drill spindles, one for the burring spindle and one for the lubricating pump. The three motors are connected to one motor starter at the left of the frame. Different arrangements of the work head and fixtures can be furnished to suit varying requirements.

Sigourney No. 0 High-Speed Bench Drilling Machine

The Sigourney Tool Co., Hartford, Conn., has brought out a drilling machine, designated as the No. 0 high-speed, bench-type, that is a departure in many respects from the regular line of Sigourney tools. As its name indicates, it is intended for bench service only, and is not provided with a column.

The machine is of the belt-driven type with two countershafts adjustably mounted upon the frame. Both belts are endless; the tension is maintained by moving the countershafts, both of which may be adjusted for center distance by turning conveniently located knurled-head screws.

The spindle, which is hardened and ground, is entirely enclosed and runs upon Norma ball bearings. There is no center hole in the spindle, but the lower end of the latter is fitted to the taper socket of a No. 1 Jacobs drill chuck that is regularly furnished as a part of the equipment. This chuck has a capacity ranging from 0 to 3/16-in. diameter drills.

Both countershafts as well as the loose pulley are

mounted upon Hess-Bright ball bearings. The normal speed of the first shaft is 1,000 r.p.m., and from this speed are obtained spindle speeds of 2,000, 4,000 and 8,000 r.p.m. The machines are capable of much higher

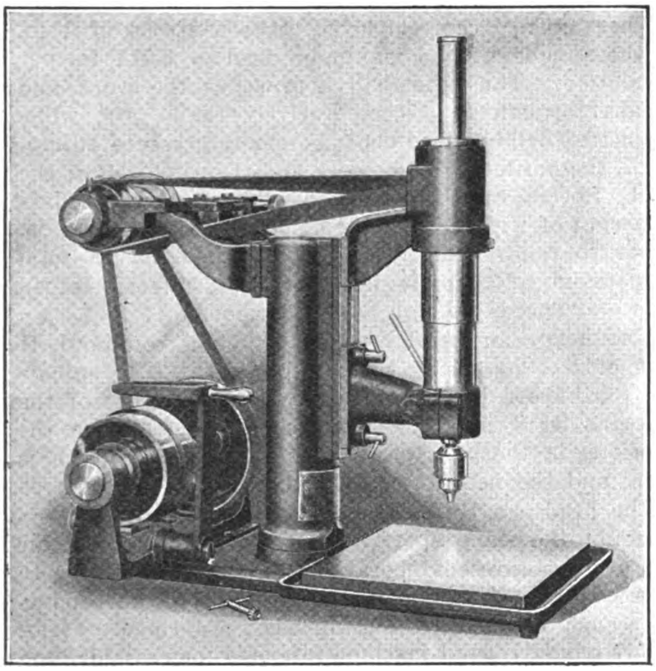


FIG. 1—SIGOURNEY NO. 0 BENCH-TYPE HIGH-SPEED DRILLING MACHINE

spindle speeds, which may be obtained by increasing the speed of the first countershaft.

The illustration in Fig. 1 shows the machine ready to run, and Fig. 2 shows a section through the spindle. It will be noted that the driving pulley is mounted independently of the spindle and that both sets of bearings are independently adjustable by means of easily accessible ring adjusting nuts. All bearings are standard commercial ball bearings, parts for which may be procured from any dealer in this class of material.

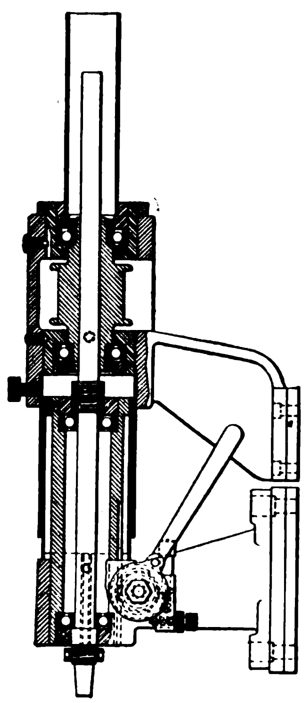


FIG. 2—SECTION THROUGH SPINDLE

The finished surface of the table is 7½x8 in. The head is adjustable vertically through a distance of 2½ in., and the maximum height from table to chuck is 3½ in. The vertical movement of the spindle is 1⅛ in., actuated by the usual rack and pinion with lever handle. The machine will drill to the center of an 8½-in. circle.

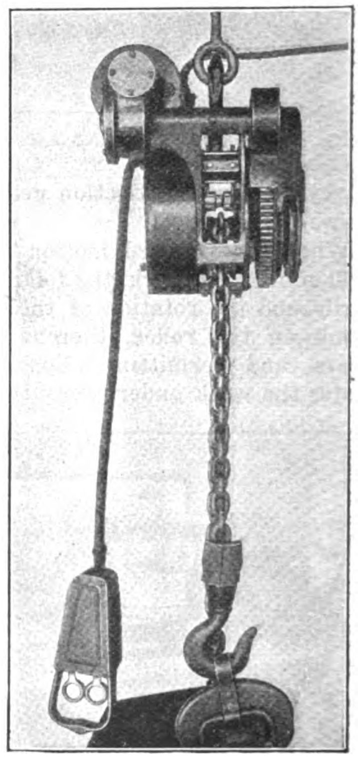
A clamp stop on the pinion shaft limits the vertical movement of the spindle, and this stop has a knurled head adjustment screw and locknut by which accurate adjustments for depth of hole are obtainable.

The machine occupies a bench space of 12x20 in. and the net weight is 50 lb. Boxed for export the gross weight is 87 lb. and the space occupied is 4½ cubic feet.

"Motorbloc" Electrically Operated Chain Hoist

An electrically operated material-handling hoist, designated as the "Motorbloc," has been placed on the market recently by the Motorbloc Corporation, Summerdale, Philadelphia, Pa. The device is intended for use in the field of operation lying between that of the standard hand-operated chain hoist and that of the traveling electric hoist which requires substantial overhead and electrical installations. The hoist is readily portable and can be installed wherever electric current is available by merely attaching it to a convenient lighting or power circuit.

The Motorbloc consists of a standardized steel chain hoist, electrified by the application of a small heavy-duty motor, reduction gearing and a slip friction clutch, all of which are mounted on a malleable-iron supporting bracket to form a self-contained electrifying unit to which the pendant controller is attached. Although the device is regularly furnished as a complete hoisting outfit, the electrifying unit can be readily applied to standard chain hoists already in service, so as to enable the operation of hand hoists by electricity. In the accompanying illustration the unit is shown built on a Franklin-Moore all-steel suspension spur-geared chain hoist. For occasional use at points where electric current is not available, or in the event of the temporary failure of electric power, the hand chain can be quickly applied, and the hoist operated as an ordinary chain block.



"MOTORBLOC" ELECTRIC CHAIN HOIST

The mechanism is manufactured for use on chain hoists having capacities from ¼ to 10 tons. It is stated to be rugged so as to stand up under continued service such as a portable apparatus of this nature is generally subjected to. However, care has been exercised to avoid stressing the chain hoist mechanism beyond the loads and speeds for which it was proportioned for hand operation. The armature shaft and worm are carried in heavy-duty ball bearings and provision is made for adequate automatic lubrication.

The pendant controller can be easily operated by the fingers of one hand, leaving the other hand free to guide the load. By this arrangement, one man can easily handle large loads. The operation of the mechanism is safeguarded by the use of a ring-oiled friction clutch which prevents over-running. At the same time, the mechanism completely protects the motor from overload without the necessity for an electric limit switch. The maker stresses such features as the compactness and balance, as well as the lightness and strength of the hoist. The weight of the one-ton size is 148 pounds.

Garrett "Millerette" Milling and Multi-Purpose Attachment

The Garrett "Millerette" or multi-purpose attachment for lathes, planers, shapers and drilling machines has recently been placed on the market by the Production Machine Tool Co., 629 East Pearl St., Cincinnati, Ohio. This device is built in three sizes for lathes from 12 to 24 in. swing.

The Millerette can be employed to convert a lathe to do the work of a milling machine with a dividing head. A large range of milling can be done, such as cutting gears, both spur and bevel, surface milling, angle cutting and spline and keyway cutting. The device enables the small shop to do many classes of milling machine work on the lathe, and it saves setting-up time on special and single-piece jobs in the large shop.

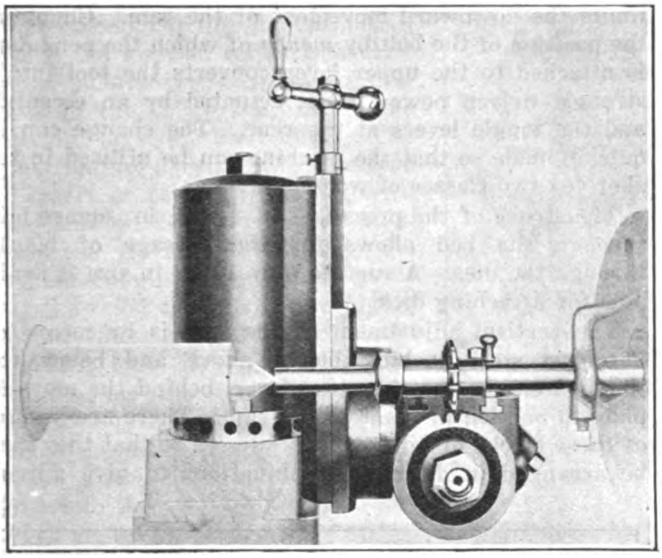


FIG. 1—GARRETT "MILLERETTE" ON LATHE

The attachment fits the toolpost slot in the top slide of the compound rest of the lathe, as shown in Fig. 1, and can be as quickly clamped in position as the toolpost itself. The lathe supplies the power and carries the cutter on an arbor between centers. It also furnishes both longitudinal and cross feeds. In addition to the movement of the top slide and compound rest of the lathe, the down slide of the Millerette can be operated by a convenient handle. The device can be set at any angle, as both the down slide and index head turn on a swivel.

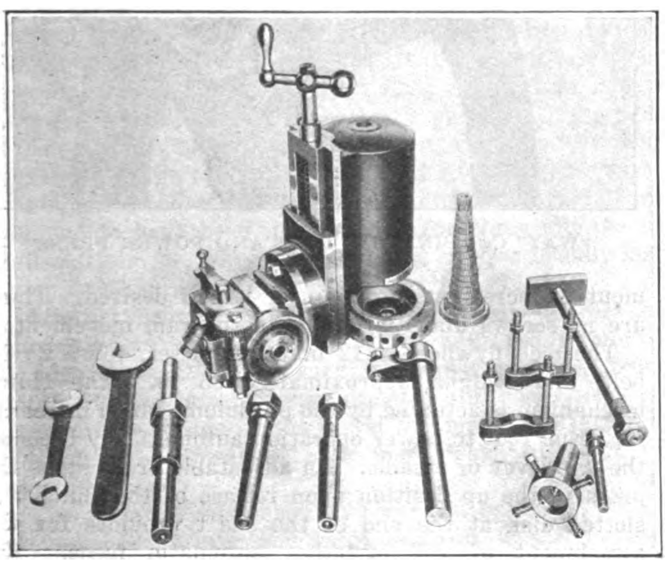


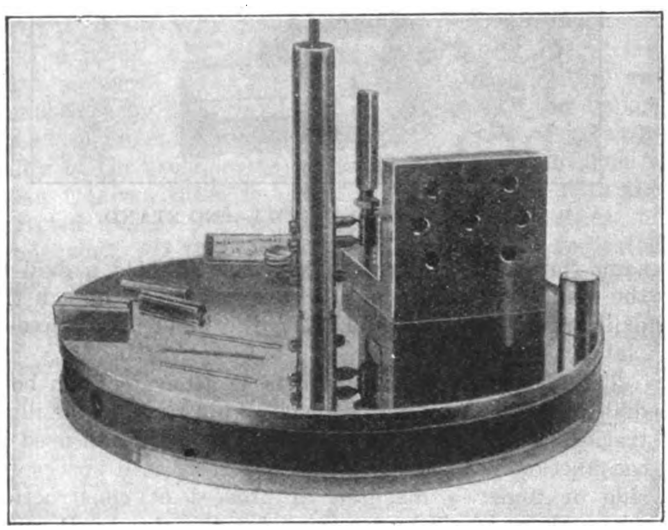
FIG. 2—PARTS OF "MILLERETTE" ATTACHMENT

On a drilling machine the "Millerette" can be used to accurately space the holes to be drilled and to hold work requiring indexing. On planers and shapers it can be used as a dividing head. The index head in connection with the change gears furnished can be quickly set up, as only two gears are used at one time. The index plate shows the gears to be used and the required number of turns of the index handle to obtain divisions from 2 to 360. The parts of the device are illustrated in Fig. 2. Adaptability in operation and rigidity of construction are claimed for the attachment.

Van Keuren Hardened and Lapped Steel Surface Plates

The Van Keuren Co., 362 Cambridge St., Boston 34, Mass., has recently added to its line of measuring tools various sizes of hardened steel lapped precision surface plates. The accompanying illustration shows the highly finished mirror-like surface on a plate 10 in. in diameter, the reflections of the tools and the work placed on the plate being very evident. The plate is suitable for general use, as well as in the toolroom.

The lapped steel surface plates are stated to have a degree of precision far in advance of hand-scraped cast-iron surface plates. They are free from the numerous hills and valleys arising from hand scraping. They are tested for planeness during manufacture by light waves. The plates are made in diameters of 5, 8 and 10 in. They are furnished with two handles which screw into the edges of the plate. A wooden box is furnished to protect the surface when the plate is not in use.



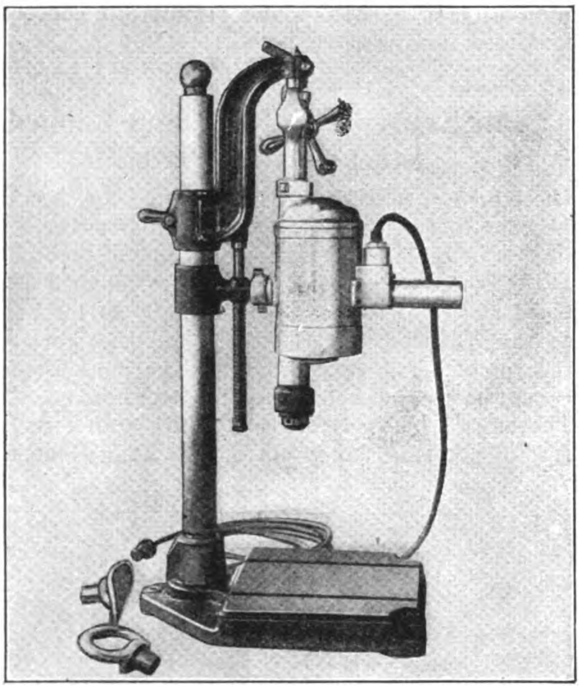
VAN KEUREN LAPPED STEEL SURFACE PLATES

For such work as the inspection of small parts by passing them between a dial gage and a surface plate, for sine bar set-ups and for measuring work where precision gage blocks are used, the lapped surface plates have advantages over hand-scraped surfaces. Gage blocks may be wrung directly on the surface plate, and the hardened steel surface wears much longer than the cast-iron surface on the usual style of surface plate.

"Way" Portable Electric Drill and Bench Stand

The A. F. Way Co., Hartford, Conn., has just placed on the market a portable electric drill to be used in connection with a portable stand by means of which the tool can be converted into a bench or floor drilling machine.

The drill, which is a complete tool without the stand, may be used as a hand tool wherever the use of such a drill is required. The breast-plate and handle that may be seen in the accompanying illustration at the foot of the machine are instantly attachable to the drill by the same "union" couplings as are used to hold a drill to the stand. No tools are needed to attach or detach the drill from the stand and place the handle and breast-plate in position.


"WAY" PORTABLE DRILL AND STAND

The screw feeding mechanism is separate from both drill and stand, and may be used as indicated in the illustration, or may be left attached to the drill and used in conjunction with an "old man" in restricted spaces inside or under a machine in process of construction where there would be no room for the stand. Because of the right-angle mounting of the hand wheel, the feed may be used in very close quarters.

The motor, which is especially built for this tool, is of the universal type, running upon either direct or alternating current, and can be furnished for 110 or 220 volts. The motor frame and casing are of aluminum. An ample circulation of air is provided.

When mounted upon the stand the maximum distance from the chuck to the base is 14 in., and there is a quick vertical adjustment of 6 in. The machine will drill to the center of a 10-in. circle. The weight of the combined drill and stand is approximately 115 lb., and the weight of the drill separately is 21½ lb. The capacity of the chuck is ⅝ in. and the motor is stated to have ample power to drive a ⅝-in. drill in steel without overheating. All gears are of high-grade steel and heat-treated. The bearings are of bronze.

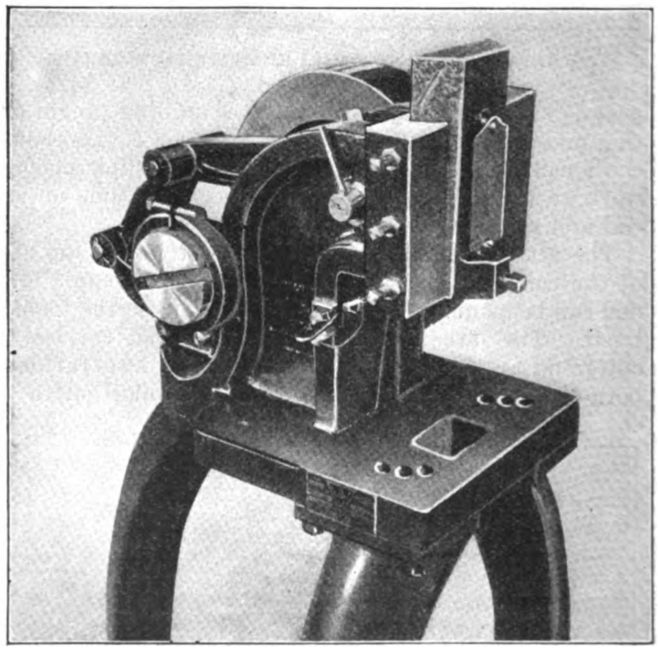
"Way" Combination Foot and Power Punch Press

The accompanying illustration shows a small press that by the changing of a single bolt, an operation which can be performed in a moment with no other tool than a screwdriver, can be converted into either a foot or power press. The machine has recently been developed and placed on the market by the A. F. Way Co., Hartford, Conn.

As a foot press it is of the pendulum type, actuated by a swinging foot-lever, or pendulum, which is permanently attached to the machine. A positive stop limits the downward movement of the ram. Changing the position of the bolt by means of which the pendulum is attached to the upper lever converts the tool into a strongly driven power press, actuated by an eccentric and the toggle levers at the rear. The change can be quickly made so that the machine can be utilized in the shop for two classes of work.

The stroke of the press is 1 in. A 2¼ in. square hole through the bed allows for the passage of blanks through the dies. A surface 5 by 12 in. in size is available for attaching dies.

The vertical adjustment of the ram is by means of hardened steel packing blocks above and below the rounded end of the actuating lever, behind the movable plate to be seen in front of the ram. There are several of these blocks of different thicknesses so that they may be arranged in different combinations to give adjustment in increments of $\frac{1}{16}$ in. or less if desired. There are no screws under pressure in the ram movement.


"WAY" COMBINATION FOOT AND POWER PRESS

The web flywheel is 12 in. in diameter, for a 2½ in. belt, and weighs approximately 65 lb. The clutch mechanism is actuated by the pendulum, which in changing from foot to power operation automatically becomes the trip lever or treadle. An adjustable brake stops the press in the up position upon release of the clutch. A slotted disk at the end of the shaft provides for the attachment of roll or other automatic feeds. The weight of the press is 325 pounds.

McCrosky Improved "Wizard" Quick-Change Collet Chuck

The McCrosky Tool Corporation, Meadville, Pa., has recently brought out an improved style of its "Wizard" quick-change collet chuck, the model being simpler and sturdier than the original one. The chuck consists of two main parts, one being a driving body having a Morse taper shank to fit the spindle of the drilling machine, and the other being a hardened slotted collar to hold the collet in the driving body.

The accompanying illustration, in which the knurled collar is broken away, shows the bayonet locking slots in the collar that admit the driving lugs of the collet. The construction permits the operator to insert or release the collet with one hand without slowing or stopping the machine. Inserting the tool is accomplished by merely pushing the collet up into the revolving chuck, where the automatic latch instantly locks it.

McCROSKY IMPROVED "WIZARD" COLLET CHUCK

Releasing the tool is brought about by pressing the knurled collar of the chuck so as to retard it, which action permits the collet to drop into the operator's hand. The chuck holds the same sizes and styles of collets that are employed with the former model.

Stewart Bearing Metal

The Stewart Manufacturing Corporation, 4535 Fullerton Ave., Chicago, Ill., has announced the development of metal for machine bearings. This Stewart bearing metal is an inseparable composition of copper and lead which can be remelted and cast any number of times under ordinary foundry conditions without segregation. The metal is especially adaptable for bearings where lubrication sometimes fails. Above 600 deg. F. the metal sweats lead and lubricates itself, and 1,700 deg. F. is the melting point.

On a segregation test, the metal was kept in a molten state 8 hours, cooled overnight and remelted in the morning. Three samples showed variation of less than $1\frac{1}{2}$ per cent in copper content, it is stated. In a test where a $1\frac{15}{16}$-in. shaft was run at a speed of 720 r.p.m. for one hour without any lubrication whatever, the temperature of the metal was raised to 1,000 deg. F. without scoring the shaft. Brasses made of the metal are claimed to have been in operation for three months in railroad service, where the ordinary brasses usually last from two hours to two weeks of service.

Stewart bearing metal is made in four degrees of hardness, to suit all operations and requirements. Grades B, C, D and E vary in Brinell hardness from 25 to 80, the latter being intended for heavy service. Standard bushings of the metal are made in 316 sizes, this range being calculated to meet nearly all ordinary requirements.

The metal is furnished in the form of tubes, which are finished all over and made in 13-in. length instead of the usual 12-in. length. It is claimed that this method reduces the waste very materially, because no machining need be done on the inside and outside as with the ordinary rough tube, and in general less waste results when cutting bushings whose lengths are integers of inches from a 13-in. tube than from a 12-in. tube.

Forbes & Myers Model 75 Electric Tool Grinder

Forbes & Myers, 172 Union St., Worcester, Mass., have recently placed on the market the Model 75 electric-driven tool grinder. The machine is similar in all respects to the Model 76 machine described on page 980, Vol. 56 of *American Machinist*, except for the fact that it is intended for single-phase current, while the Model 76 grinder utilizes multi-phase current.

The chief feature in the design of the grinder is that the motor has all the windings on the back side, and the front of the housing is flat. Thus, with the 6-in. wheels that are mounted on the motor shaft, three-fourths of a wheel can be worn away before the face is even with the front of the motor. The arrangement of the motor, guards, tool rests, ball bearings for the spindle and such points is the same as previously described for the Model 76 machine. If desired, the machine can be equipped with a cord and plug so that it can be operated from an ordinary lighting socket.

Two Gentle Reminders for Punctuality

By Frank V. Faulhaber

The plant that has experienced difficulty in getting its employees in on time might well consider the example set by one factory, which impresses the importance of punctuality upon its men from the very beginning of their employment. In the first pay envelope a man receives there is included a small card, with the printed motto: "Punctuality expresses earnestness of endeavor." If the new man's time card has indicated good time, there is added the encouragement in handwriting, "Keep it up!"

The new man who receives such encouragement will usually be impelled to report on time as often as possible, while to the man whose card signifies he is somewhat tardy there is thus provided a reminder that cannot but help get in its good work. The plant keeps close tab on the men's time reports and it has found that some of the tardy individuals are inclined to go out later than the others.

The executives realize, however, that it is wisest to get the men to come in on time, to go out on time, and thus to make for uninterrupted production. To those employees who seem to err there are given cards, via the pay envelope, with the suggestion: "A few early minutes are of more value than a few late ones." These two enclosures have worked wonders for the plant, bringing about better punctuality and willingly than might result from strict rulings.

There is an additional value to a brief notice in the pay envelope. It indicates to a man that he is a unit of notice rather than an overlooked cog in the plant. To the punctual employee it offers a word of appreciation, which is always welcome. The tardy employee cannot fail to realize that there is a warning, however slight, to buck up on time.

News Section

Plans Power Exposition and A. S. M. E. Convention

The National Exposition of Power and Mechanical Engineering to be held at the Grand Central Palace in New York from Thursday, Dec. 7 to Dec. 13, closing however, on the intervening Sunday, is being planned in cooperation with the national societies interested in the economy of fuel and in the production and use of power generated therefrom.

The opening of the exposition in the Grand Central Palace will take place on the closing day of the annual meeting of the American Society of Mechanical Engineers, and time has been set aside in the A.S.M.E. program so that members desiring may attend the opening exercises.

In addition, the A.S.M.E. professional divisions on aeronautics, ordnance, and forests products will hold sessions of general interest to the engineering profession.

The American Society of Refrigerating Engineers is to hold its meeting at the Hotel Astor for three days commencing Dec. 5, and its members, as well as the members of the A.S.M.E. will be admitted to the exposition upon the presentation of their membership cards.

The exposition is fortunate in having an advisory committee that understands the importance of a greater popular appreciation of the engineering problems involved in the production and use of power. The committee is made up of Irving E. Moultrop, of the Edison Electric Illuminating Co. of Boston, chairman; Dexter S. Kimball, president of the American Society of Mechanical Engineers; Alexander G. Christie, chairman, power division, A.S.M.E.; Fred Felderman, national president, National Association of Stationary Engineers; Milan R. Bump, president, National Electric Light Association; N. A. Carle, vice president, Public Service Production Co. of New Jersey; E. B. Katte, chief engineer, electric traction, N.Y.C.R.R. Co.; Fred R. Low, editor, *Power;* David Moffet Myers, consulting engineer; Calvin W. Rice, secretary, American Society of Mechanical Engineers; and the managers, Charles F. Roth and Fred W. Payne, with offices in Grand Central Palace.

New A.S.M.E. Section Formed in Massachusetts

The newly formed Western Massachusetts section of the American Society of Mechanical Engineers has chosen as its chairman Charles L. Newcomb, works manager of the Worthington Pump & Machinery Co., Holyoke, and as its vice-chairman, George E. Williamson, executive engineer of the Strathmore Paper Co., Mittineague and Woronoco. The executive committee comprises A. L. Bausman, Springfield; F. O. Wells, Greenfield, and A. F. Blaisdell, Pittsfield. This section starts with a membership of about 200. It is affiliated with the Engineering Society of Western Massachusetts, representative of different branches of engineering, and out of which a number of sections or chapters of national engineering organizations are being formed, that members may become more closely in touch with the leaders in their respective engineering lines.

August Implement Exports Reach High Mark

Exports of agricultural implements from the United States during the month of August were valued at \$3,352,657. This is the first month in which exports of agricultural implements have reached the \$3,000,000 mark since July, 1921, and the value is the highest figure attained since April, 1921, in which month the exports in this line amounted to a value of \$4,081,333. During the three succeeding months, viz., May, June, and July, 1921, exports of implements were \$3,275,126, \$3,262,641, and \$3,266,860, respectively, but in no case did they equal those for August of this year. After July, 1921, exports of agricultural implements dropped very rapidly, going considerably below \$1,000,000 in both November and December of that year.

Exports for August, 1922, exceed those for the same month in 1921 by \$1,294,258. This is interesting, not only as showing an improvement in the demand for American implements abroad, but also because it is the first month since February, 1921, when the exports for any month have been greater than those for the corresponding month in the preceding year.

Esthonians Interested in American Machinery

Consul Albrecht, Reval, reports to the Department of Commerce that machinery and other products obtained from Germany at present are reported as being very frequently of inferior quality. Furthermore, it is stated that no assurances can be obtained as to price or time of delivery with reference to such goods, which generally are received at a much later period and cost considerably more than anticipated.

Indications are, the consul says, that American manufacturers might do business here with the local factories if the latter had fuller information as to their products, prices, terms of sale, and time required for delivery.

Except for one wood-working factory which placed important orders for American machinery as a result of a business trip of their representative in the United States, it is believed that none of the larger factories have ordered any machinery from America.

Ten Years' Progress in Management

As a part of the program of "Management Week" the American Society of Mechanical Engineers, the Society of Industrial Engineers and the Taylor Society held a joint meeting on Oct. 17 at the Engineering Societies Building. The title of the paper for the evening was "Ten Years' Progress in Management." It was received with a great deal of interest on the part of the large gathering and several engineers of note contributed to the discussion.

There was a distinct *American Machinist* flavor to the meeting inasmuch as the speaker, L. P. Alford, and the presiding officer, Fred J. Miller, both are ex-editors of this paper.

The object of Mr. Alford's paper was to report on the progress of management that has been made since the report of 1912, by a committee on the state of the art of industrial management at that time.

Among those who took part in the discussion were Myron H. Clark, of the U. S. Rubber Co.; Frank B. Gilbreth, of Frank B. Gilbreth, Inc.; John H. Williams, of Day & Zimmermann; Prof. Jos. W. Roe, New York University; and C. E. Knoeppel, of C. E. Knoeppel Co., Inc. Professor Roe read an English paper outlining the progress of management in that country and Mr. Knoeppel read abstracts from a German paper, showing the point of view of the Germans in regard to the development of management in that country and in the United States.

Dr. Stratton Elected to Head M.I.T.

Dr. Samuel Wesley Stratton, for twenty-one years director of the Bureau of Standards at Washington, was elected president of the Massachusetts Institute of Technology last week. He will assume the position on Jan. 1.

Dr. Stratton was born in Litchfield, Ill., in 1861, and was graduated in 1884 from the University of Illinois, where he later become professor of physics and electrical engineering. From 1892 to 1901 he was with the physics department of the University of Chicago.

Flinn Heads Engineers

Election of Alfred D. Flinn as Director of the Engineering Foundation, which is fostering organized industrial research on a nation-wide scale, was announced last week by Charles F. Rand, Chairman of the foundation. Mr. Flinn is the first incumbent of the new post, created by the foundation's Governing Board, composed of the Four Founder Societies of civil, mining, mechanical and electrical engineers.

He has been identified with municipal engineering enterprises in New York and Boston and was formerly a lecturer in Lawrence Scientific School of Harvard University.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

PRESIDENT HARDING, in his letter to Representative Mondell, published last week, said that "the national fiscal policy has been directed to arrest the rapid deflation which had set in" and that the business outlook is brighter "than at any time since the mistaken program of drastic deflation was adopted by those then in control of the government."

These statements read in connection with the reports from Washington that the President will not reappoint the man who was at the head of the Federal Reserve Board when the "mistaken program of drastic deflation was adopted" have been construed to mean that the Administration will not for the present oppose or attempt to check the credit expansion now in progress.

The logical result has been a continued advance in most commodity markets. Wheat is now about 15 cents above the lowest price recently recorded. Cotton has risen to the highest figure of the year. Rubber has sold at 23¾ cents, which is nearly 10 cents above the value when I first called attention to its subnormal cheapness in these letters. Sugar is up half a cent a pound, with every prospect of advancing further when the Cuban loan is arranged. Wool is firm and higher all over the world. So are silk, hides, leather, iron, steel, tin, tobacco and most basic commodities.

There has been a seasonal slackening in the demand for gasoline, as well as for lumber, brick and other building materials, copper still reflects Europe's inability to buy freely and a severe decline threatens a heavily overstocked egg market, but these are the only important exceptions to an upward tendency that is noticeable in nearly every department of domestic trade. That it is likely to continue is to be inferred from the fact that there has been no anticipatory buying as yet. Merchants are still cautious. Stocks are light. They have to be continually replenished and replacement orders are a sustaining and stimulating influence.

But notwithstanding the buoyancy of the commercial markets generally, bonds, including all Libertys, except the 3½s, are lower and the stock market has become spotted and irregular despite the fact that the 500 million Government bonds offered at 4¼ per cent were three times oversubscribed and the continued declaration of stock dividends by the Standard Oil companies and several other corporations that have taken similar action.

The money market meantime continues to harden and the gradual absorption of floating capital is indicated by higher rates for both call and time loans.

These developments all reflect what is called inflation by some and prosperity by others, but whatever it is called I see no reason to change my prognosis of last week, which was for a further and extended rise in commodity prices and a period of liquidation in most bonds and stocks except those of the railroad companies whose earnings will be increased by the activity of business.

I am not shaken in this view by the factitious activity of some of the highly speculative oil stocks and I am confirmed in it by Henry Ford's announcement that he has made a cut of about $50 in the price of all his cars. This may mean a war in the automobile trade that only the fittest will survive.

> **The graphic chart of business movement appears to indicate that a critical stage has been reached in the recovery from the depression of 1920-1921. Disturbing factors are beginning to appear. Rivalry to secure labor and materials is rapidly bidding up prices on commodities and wages. The situation calls for clear thinking to avoid disaster. Distinction must be made between an expansion resulting from steady, healthy growth and that sort of expansion which results from temporary hysteria and eagerness to reap big and quick profits.**

The automobile securities now listed on the New York Stock Exchange and the Curb represent values that run into the billions and any serious reduction in the profits of the motor trade is sure to be reflected by a decline in the motor stocks.

The incident is an apt illustration of the way in which markets that are "over bulled" may receive a blow from an unexpected quarter.

The other news of the week is not especially significant. The coal problem is being well handled. Production is large and the distribution is being fairly controlled. An acute shortage anywhere seems unlikely, but economy and forbearance will be necessary. The railway congestion is unrelieved and the steel industry is somewhat hampered by it.

The weekly statement of the Federal Reserve System shows a reduction of ½ of one per cent in the reserve ratio, which now stands at 75.2. Rediscounts show a gain of $24,000,000, as might have been expected from the increased activity at rising prices in the commodity markets. The gold on hand shows a reduction of $3,000,000, which is probably due to the efforts that are being made to put "yellow backs" into circulation.

Great Britain has paid $50,000,000 on account of the interest due on her debt to our Government.

Secretary Hoover's speech at Toledo has attracted much attention. In his opposition to the suggestion that we should forgive any substantial portion of the debt due us by the other Allies it is assumed that he spoke for the President.

The political fight in which Lloyd George is engaged is watched with much interest here, but its issue is not likely to have any immediate effect upon business in this country.

Economic conditions in Europe seem to be improved and sterling exchange advanced early in the week, although it weakened when the British Cabinet resigned.

Francs are lower and marks show no rallying power as the printing press continues to turn them out at the rate of about five or six billion a day. The total amount outstanding Oct. 14 is put at 375 billions, but the figures have ceased to be significant. It is reported that the German government will shortly issue gold notes or certificates against the 1,005,000,000 gold marks held by the Reichsbank and that these will be used to buy up paper marks at about present prices.

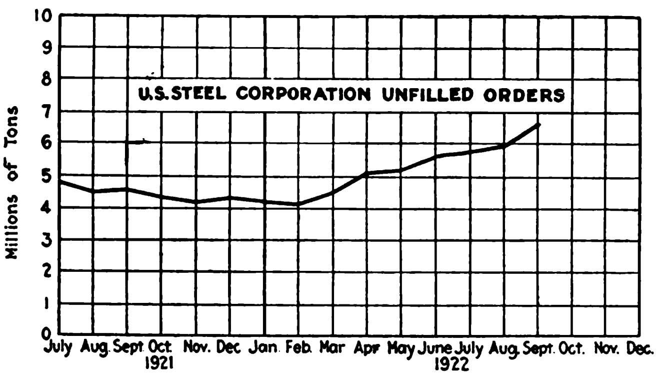
This is the policy followed by our own United States government during the Civil War when both gold and paper money were in circulation. It might work if Germany's credit was good enough to enable her to draw additional gold, but 1,005,000,000 marks, equal to only about $240,000,000, won't go very far and it is to be feared that the new currency if issued will be hoarded and soon disappear.

Conditions in Russia are rapidly mending if the news from there is to be credited, and in the Balkans and the nearer East there is an unusual approach to comparative tranquility. In Latin America also the outlook seems to be improving and the shares of the Argentine railways have advanced quite sharply in London upon the prosperity reported in the country they serve.

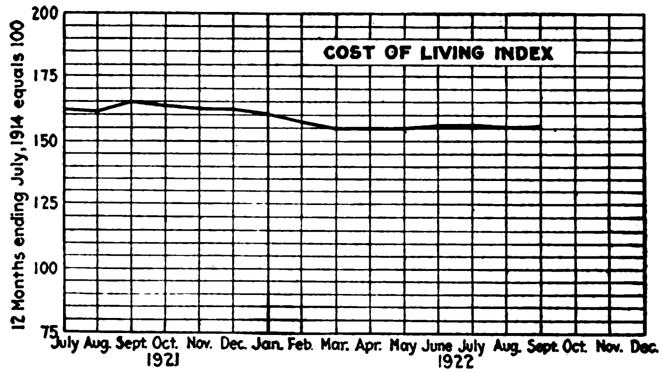
A higher barometer and clearing weather is in fact reported from all over the world and for the present at least the trade winds are favorable and it seems safe to carry a fair spread of canvas in foreign as well as domestic waters.

Replies received from a questionnaire recently sent out by the American Manufacturers Export Association to a large number of firms engaged in foreign trade carry a distinct note of optimism, and indicate a general increase in the size and number of orders from abroad.

Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.



Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.



UNFILLED ORDERS on the books of the U. S. Steel Corporation on September 30, 1922, totaled 6,691,607 tons, as compared with 5,950,105 tons on August 31, of the current year. The September figure represents the highest point reached since February, 1921. This increase in tonnage over August, amounting to 741,502 tons is the largest increase recorded for any single month of the current year. The great demand for fabricated steel for construction purposes, coupled with heavy railroad buying accounts in a large measure for the increase.

Cost of living among wage earners' families in the United States on September 15 was 55.6 per cent higher than in July 1914, according to figures collected by the National Industrial Conference Board. Between August 15 and September 15 there was an increase of seven-tenths of one per cent. The changes in the budget within the month were slight increases in both clothing and food prices and a continued increase in fuel prices resulting from an unstabilized coal market. As compared with the high point reached in July, 1920, figures for September, 1922 represent a drop of 48.9 points or 23.9 per cent.

Metal product share markets, in keeping with industrial issues generally, held up well during September, the average price of ten representative issues being $77.23 per share as compared with $75.65 in August.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0295	$0.0285	$0.0273
Cold finished shafting......	per lb.........	0.0378	0.0373	0.0379
Brass rods.....	per lb.........	0.171	0.1700	0.148
Solder (½ and ½)	per lb.........	0.23	0.228	0.20
Cotton waste..	per lb.........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100.....	3.11	3.11	....
Lard cutting oil	per gal.......	0.575	0.575	....
Machine oil....	per gal.......	0.36	0.36	....
Belting, leather, medium......	off list........	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

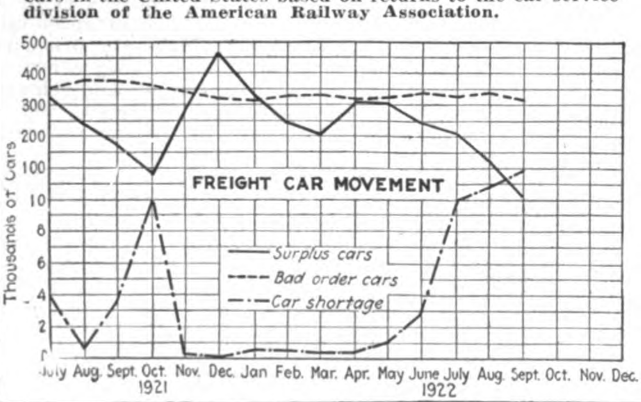
The agricultural implement industry shows marked improvement with an encouraging export demand. Electrical companies have, within the past three months, booked a very large volume of business, and a general betterment is reported in other issues.

Railroad rolling stock condition at the movement is the center of considerable attention and no little concern. The car shortage for the weekly period which began on August 23 and ended on August 31 was reported as 58,670 for American roads. By September 30, the shortage had reached 138,170 cars. The average for each weekly period of September amounts to about 100,000 cars. Car surplusage shows a corresponding decline from 70,455 cars on August 31 to 6,593 cars on September 30, an average for the month of about 21,000. Cars in bad order have decreased. On September 1, the total freight cars of all classes reported in need of repairs numbered 321,674 or 14.1 per cent of the total on line. By October 1, this class of cars had fallen to 291,654 or 12.8 per cent of the total.

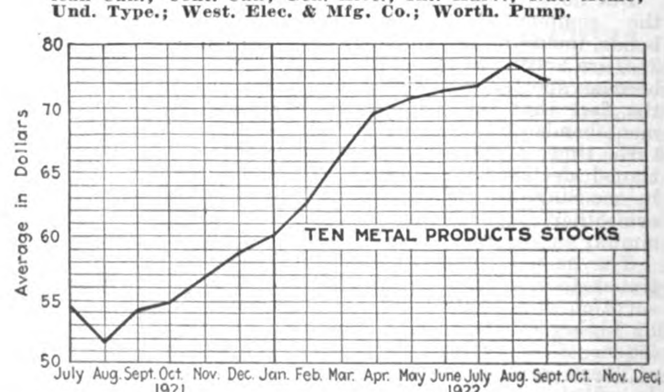
Reserve ratio of the Federal Reserve system for the week ending October 18 amounted to 75.2 per cent as compared with 75.7 per cent in the week previous. The Bank of England in the same period reports a ratio of 19.93 per cent, 19.97 per cent being the year's high point.

American foreign trade for September shows exports valued at $317,000,000 as compared with August of $301,804,618. Imports total $232,000,000 as against August total of $281,411,705, an excess of exports of $85,000,000.

Monthly average of car shortage, surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can.; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West. Elec. & Mfg. Co.; Worth. Pump.



S.I.E. Annual Convention

Beginning with registration on Wednesday morning October 18th, the Society of Industrial Engineers, at its ninth Annual Convention, carried through a large and important program that was concluded by the Friday evening meeting devoted to the subject of materials handling. In connection there was held an equipment exhibition at which machinery of various types, particularly interesting to managers, was shown.

Officers elected for the coming year were: President, Joseph W. Roe, head of the department of Industrial Engineering, New York University; treasurer, F. C. Schwedtman, vice-president, National City Bank, and George C. Dent to the office of secretary and business manager.

The subject of the entire convention was "Economic Industry—Fundamentals Necessary to Obtain Maximum Production with Minimum Waste of Effort and Cost." The individual subjects taken up were: Relation of Economics to Industry, Economics part in the Formation of a Policy of Business Administration. The Economic Background Necessary for a Business Executive, The Relation of Fatigue Elimination to Other Activities, The Budget and the Financial Forecast, The Importance of the Elimination of Waste to the Economic Structure, How Can We Reduce Production Costs? What Keeps Workers Contented? The Relation of the Economists to Business, Finance and Industrial Economics, The Measurement of Management, Industrial Accounting, Reducing Sales Costs, The Scientific Selection of People for Jobs, Economic Aspects of production, and Materials Handling.

Tests for Applicants

The Industrial Relations Division, under the chairmanship of Earl B. Morgan, Manager of the Employment and Service Department of the Curtis Publishing Company, had an extremely interesting session. Mr. Morgan pointed out the value of having a pleasant stage setting for interviewing applicants for positions. By putting the prospective employee at ease and treating them courteously, you can find out much more readily if they are the kind you can use to best advantage. Many a concern makes innumerable enemies by ill treating applicants for positions and this frequently reflects on the business in unexpected ways. Courteous treatment on the other hand makes a friend of the applicant even if there is no position for them. And firms with the reputation of fair treatment get the best employees, for the best employees pick employers as well as employers picking the employees.

Mr. Morgan is much more impressed with practical tests than with written examinations. Standard questions are soon learned by floaters and these, most undesirable workers frequently pass such tests higher than the men you want. He also decried the idea that there should not be honest and healthy competition for employees as well as for business. If a man is worth more to you than his present employer is paying him, both you and the man have a perfect right to get together.

Miss Louise Moore, Employment Director for the Dutchess Mfg. Company of Poughkeepsie, brought out a number of interesting points such as the desirability of watching the kind of people who work well together. One class in her vicinity is very rapid but not quite so accurate as another class which is less speedy. She finds good results in mixing these classes in different departments rather than having either predominate in any one place.

In the same way great care should be taken in sending workers to different foremen. Certain kinds of foremen get along best with men of one type, other foremen prefer entirely different kinds of men. In the past much stress has been laid on preventing labor turnover, which is of course very expensive. And yet it is even more important to get the different people sorted into their proper jobs, where they can develop if possible and where they can earn the most for the company and for themselves.

Several means of reducing production costs and keeping workers content were described by Messrs. J. A. Faust, Wm. Geiger, Chas. Cheney and O. L. Prible on Thursday afternoon. Perhaps the most strongly emphasized factor was the disastrous effect of cutting prices. Discussion on this point brought out the fact that the sentiment against this practice was unanimous.

Frederick E. Rein of Philadelphia speaking of the measurement of management showed conclusively how measurement was accomplished in the dairy industry. The discussion that followed indicated that there is considerable hope that some day there will be established a unit which will permit the measurement of management, and production as well, in all industries. There was no claim made that any such unit has been discovered but the conclusions expressed indicated that many are thinking along that line. It was recognized that the difficulties of measuring management are many when compared with the difficulties of measuring the accomplishments of individual workers. Suggestions were made that it would be advisable to give more attention to the measurement of the efficiency of supervision and indirect labor.

At the Friday afternoon session Ernest F. DuBrul, General Manager of the National Machine Tool Builders' Association, gave one of his clear expositions of economic fact and theory which have made him so popular a convention speaker. Among other things he brought out the difference between the demand catered to by manufacturers of consumer goods and that supplied by makers of producer goods such as machinery. The other speaker was Dr. Arthur J. Todd, Director of Labor, B. Kuppenheimer & Company, Chicago whose topic was "The Industrial Age."

Dr. Richards Inaugurated President of Lehigh

Before an audience of delegates from other colleges, alumni and undergraduates of Lehigh and friends of the University which crowded the spacious Packer Memorial Chapel, Dr. Charles Russ Richards, former Dean of the College of Engineering of the University of Illinois, was inaugurated president of Lehigh University, at its annual Founder's Day celebration held in Bethlehem, Saturday, October 14.

Implement Makers Discuss Railroad Situation

Enactment of a law placing railroad employees in a preferred class, with wages fixed periodically upon a slightly higher basis than those paid in other industries, but predicating the passage of such a measure upon making railroad strikes a felony and upon granting to the railroads a fixed rate of return upon their property values were among recommendations for a possible solution of the carriers' difficulties, made last week by W. H. Stackhouse of Davenport, Iowa, speaking at the twenty-ninth annual convention of the National Association of Farm Equipment Manufacturers, in Chicago.

"Such a measure should effectively protect the country from a repetition of the disastrous strike through which it recently passed, and usher in an era of comparative tranquility in so far as the nation's railroad transportation industry is concerned," Mr. Stackhouse maintained, especially "if employment would at all times be open to men and women of proper qualifications, regardless of their affiliation or non-affiliation with any organization whatever."

Speaking on "Industrial Freedom," he referred to the situations in the coal and railroad industries, pointing out the peril to the public in the use of force in industrial disputes and in the "dangerous method of securing special privilege through the medium of group legislation," under threats of political extinction.

The address of Mr. Stackhouse, the keynote speech of the convention, was received enthusiastically by the 461 delegates present and brought to a close one of the most successful conventions in the history of the association.

Other addresses during the convention were: The Transportation Problem of 1922, by C. H. Markham, president, Illinois Central R.R.; Our Mutual Problems, by R. H. Lathrop, president, National Federation Implement Dealers' Association; Rotation in Trade, by Guy H. Hall, Chicago; European Conditions, by G. A. Ranney, International Harvester Co.; The Present and Future of the Implement Industry, by F. R. Todd, vice-president, Deere & Co.; Depreciation, by T. F. Wharton, Deere & Co.; The Implement Trade Press, by L. C. Pryor, editor, *Farm Implements and Tractors;* Simplified Practice in the Implement Industry, by Wm. A. Durgin, Department of Commerce; The Dealer as an Asset, by Grant Wright, Eastern Federation of Implement Dealers; and, Agricultural Conditions in America Today, by James R. Howard, president of American Farm Bureau Federation.

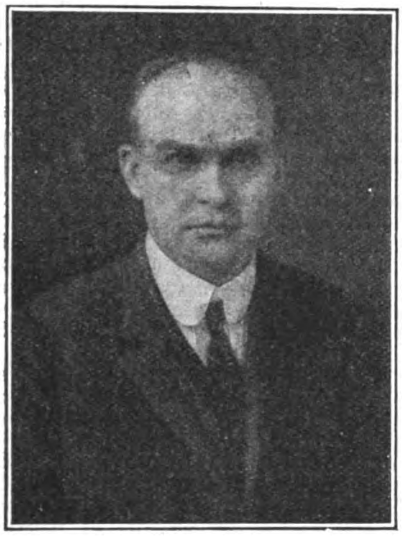
Officers elected for the ensuing year were: President, J. B. Bartholomew, president, Avery Co., Peoria, Ill., and F. R. Todd, vice-president of Deere & Co., was elected executive chairman.

August Electrical Exports Show Slight Decline

Shipments of electrical equipment from the United States during August show a slight decline as compared with the previous two months, the decrease from the July total being approximately $300,000.

Death of John Bergone Foote

Those who attended the last convention of the American Gear Manufacturers Association can hardly realize that John Bergone Foote is no longer with us. He died suddenly Oct. 14, but four days after presiding as toastmaster at the A. G. M. A. dinner on the 10th. Born in Chicago in 1865 he attended the public schools until he was 14 and then went to work for the Chicago Stamping Co. as a die setter. Following the metal stamping business he became foreman of the press and stamping room of the Cragin Manufacturing Co. at the age of 17, after which he turned his attention to lathe work, finishing the die and tool making trade when he was 21. From there he went to Norton Brothers which afterward became the American Can Co., as die and tool maker.



In 1887 and 1888 he was superintendent of the Cragin Manufacturing Co., leaving there to take charge of the machine shop of the American Can Company where he remained until 1893. He then became a designer and builder of special machinery for the Fisher Manufacturing Co., but the same year, 1893, entered a partnership with D. O. James to manufacture cut gears. A disastrous fire wiped out everything but the good will the next year and he then organized the Foote Bros. Gear and Machine Co. The building of that organization from a heap of ashes to a two million dollar concern was an achievement of which Mr. Foote was justly proud, and stands today as a fitting monument to his genius.

Ever since the organization of the American Gear Manufacturers Association, Mr. Foote was active in its behalf, being a director at the time of his death. His last work for the association was the preparation of a report on apprenticeship, in which he was deeply interested. In addition to his gear interests, he was also a director in the Barton Spider Web Re-Enforced Concrete System, President and Director of the Illinois Tractor Co., a member of the Society of Automotive Engineers, Illinois Athletic Club, the Oak Park Elks and treasurer of the Butterfield Country Club of Oak Park. He will be greatly missed, for he was always an active participant at all conventions.

Alabama Pig Iron Output Reaches Record

Pig iron production in the Alabama district, the Southern Metal Trades Association advises, is now on a basis of about 205,000 tons per month, the highest point in more than two years. It has increased steadily from month to month since the first of the year, and October melt will be the biggest month of 1922 to date. The outlook for 1923—the early part of it at least—is the brightest since the inflation period immediately following the World War when production was at the highest point in history all over the South. Furnace companies are well sold ahead and orders for early 1923 delivery are being received in far greater volume than up to this time in 1920 or 1921.

Prices also are continuing to climb steadily, some change having been noted each week for the past two months. Quotations are at $30 per ton for No. 2 foundry iron, though it is being purchased by the regular buyers at around $28.50. Quite a few sales at these prices have been made for 1923 delivery. No decline in prices is looked for in the immediate future.

The association also advises that iron and steel conditions are now generally better over the entire South than they have been in the past two and a half or three years, with the outlook giving promise of 1923 as a normal year. Furnaces are operating steadily outside the Alabama district with plenty of business to insure a steady activity.

Export business in iron and steel products out of southeastern ports also has been picking up considerably of late, and a considerable tonnage of miscellaneous products is going to Latin-America and to far eastern countries, principally machinery of various types.

Goodson Sees Great Opportunity Abroad

B. F. Goodson, president of the American Equipment Co., Detroit, Michigan, who recently returned from a tour through England and France, says that the industrial conditions there are in such a state that the manufacturers of the United States have an exceptional opportunity for capturing the foreign trade. He states that the labor element, which is very strong, has secured the passage of laws that provide for the payment of a weekly stipend to unemployed workmen, with the result that many of them only perform enough labor to retain their membership in the unions. Industry is practically paralyzed and conditions are growing worse instead of better. Mr. Goodson's statements are based on a study of conditions in the districts of London, Manchester, Birmingham and Paris, in each of which he spent some time.

Mr. Goodson also says that the German machine tool manufacturers are selling on terms of one-third c.o.d. and the balance to be paid in small payments extending over a period of two years. This is their bait to the South American countries and with which they expect to win trade away from the United States. Their prices are much lower than American prices and they are copying everything of value.

Business Items

The Skelton Shovel Co., Inc., Dunkirk, N. Y., is building a factory in that place to manufacture a complete line of solid shank one-piece shovels and expects to be in production by February, 1923.

The Traylor Engineering and Manufacturing Co., Allentown, Pa., has enlarged its plant in that city for the purpose of consolidating its truck and spring business.

The Peerless Machine Co.. Racine, Wis., has moved into new and larger quarters at 14th and Clark Streets, that city, in order to accommodate the expansion resulting from the sales of its universal shaping saw.

The Clayton Manufacturing Co., Bristol, Conn., manufacturer of steel shears, etc., has recently increased the capital stock of the concern from $100,000 to $150,000.

The Fisher Body Corporation will begin work in Janesville, Wis., on a building containing 96,000 square feet of floor space, for the construction of from 100 to 150 bodies daily.

The U. S. Government will construct at Hoboken the largest pier at any port in the United States for the accommodation of the giant liner Leviathan.

The Chevrolet Motors Co. will erect a one-story building at Janesville, Wis., for the assembly of its cars, the plant to be 500 by 125.

The Atlantic Coast Line Railway has awarded contracts for double-tracking from Bennett, S. C., to Doctortown, Ga. The company placed an order for 30,000 tons of steel rails.

Pollard Bros., Chicago, manufacturer of steel bench legs, benches of all kinds, bar stock racks, lawn and porch furniture, have outgrown their present quarters and are moving to larger quarters. Their new address will be 3670 Milwaukee Avenue, Chicago, Ill.

The Westinghouse Electric and Manufacturing Co. announces the transfer of the Krantz works, Brooklyn, N. Y., to Mansfield, Ohio.

The Ford Motor Co.'s new Green Island plant, according to an announcement from Albany, New York, is expected to be completed during October and ready for the installation of machinery.

The Bethlehem Steel Corporation will spend immediately $15,000,000 on its newly acquired Lackawanna Steel Co. plant in Buffalo.

The Mack Trucks, Inc., for the third quarter of the current year will show net earnings of $1,315,633 after taxes and charges, or $3.64 per share on the common stock after preferred dividends.

The Automatic and Electric Furnaces, Ltd., London, England, announces that owing to the increased demand for the Wild-Barfield Electric Hardening furnaces, it has been compelled to seek larger quarters and on and after Oct. 1, the company's new address will be: Automatic and Electric Furnaces, Ltd., Elecfurn Works, 173-175, Farringdon Road, London, E. C. 1.

The American Locomotive Co. is planning the erection at its Schenectady

plant a large shop for the construction of mechanical parts of locomotives and for packing engines for foreign shipment.

The Central Foundry Co. plant at Holt, Ala., known as Plant No. 3, was damaged by fire this month, the loss amounting to more than $50,000, largely covered by insurance.

The Fleming Machine Co., Springfield, Mass., is increasing the production of its new valve grinder, which is equipped with two motors, with size reduced to two square feet and weight to 100 pounds. The output is about to be increased to ten a day. Sales agencies are being appointed in every state and numerous foreign countries.

The Spartan Saw Works, Springfield, Mass., has filed plans for a new factory building in Fisk Avenue, to cost $14,000.

The Gilbert & Barker Manufacturing Co., West Springfield, Mass., continues to operate three eight-hour shifts a day, including Sunday, in all departments, and it is stated that orders are sufficient to assure this plan of operation for the rest of the year.

The L. S. Starrett Co., Athol, Mass., having sold the bulk of stocks accumulated at the beginning of the dull season, has advanced its production schedule to four days a week, this applying to all departments except the hack saw works, which run on full time.

The New Home Sewing Machine, Orange, Mass., has posted a notice of an increase in wages averaging about 10 per cent in the various departments.

The Southern Sheet Metal Co., organized recently with W. M. Blecker as president, is planning the establishment at Chattanooga, Tenn., of a steel mill consisting of an eight sheet plant, and three sixty ton open hearth furnaces. The estimated minimum capacity of the plant will be 55,000 tons per year. The company will be capitalized at $1,100,000, and W. J. Lynch, vice-president, is now in Chattanooga conferring with capitalists relative to the establishment of the plant.

The National Cast Iron Pipe Co., of Tarrant City, Ala., plans to remodel and enlarge its plant, the work to be carried out within the next few weeks. Considerable new machinery is to be installed in the shops.

The Brown Instrument Co., manufacturers of pyrometers and other recording devices used in industrial plants, announces that a southern district office has been established at Birmingham, Ala. The Birmingham office is in the Brown-Marx building, the district being under the management of Charles L. Saunders. An ample stock will be carried at Birmingham to supply the company's trade in the southern territory.

The Roane Iron Co., of Rockwood, Tenn., a few days ago suffered a loss of more than $100,000, when fire of unknown origin swept the plant. The loss was largely covered by insurance and the destroyed unit probably will be rebuilt before the end of the year.

The Precision and Thread Grinder Manufacturing Co., 1 South Twenty-first St., Philadelphia, Pa., manufacturer of the multi-graduated precision grinder, thread lead variators and permanent alignment wheel trueing heads, which was recently acquired by A. T. Doud, president of the company, announces the appointment of William H. Frick as chief engineer in charge of engineering, development and service departments. D. F. Bruce, formerly with the McCambridge Co., as superintendent, has been appointed superintendent in charge of manufacturing and production.

The General Electric Co. for the three months ending Sept. 30 reports that orders have been 42 per cent greater than for the corresponding three months in 1921, according to a statement to the stockholders made public by Gerard Swope, president.

The Pittsburgh Steel Co. and subsidiary companies for the fiscal year ended June 30, 1922, shows in its report a net income for the year of $861,833.28, after charging off for depreciation and depletion $866,000, reduction of inventory values $65,000 and including in operating costs $1,547,000 for maintenance, repairs and replacements.

The Moon Motor Car Co. has declared a quarterly dividend of 25 cents per share on its common stock payable Nov. 1.

The Austin-Western Road Machinery Co., Chicago, has absorbed the Wilson Tractor Manufacturing Co., Ottumwa, Iowa.

The General Piston Ring Co., Indianapolis, Ind., is the new name for the company formerly known as the Teetor Manufacturing Co.

The Hillman-Ayers Manufacturing Co. has been incorporated in Kansas City, Mo., with a capital of $5,000, to manufacture, deal in and with, gas generating oil burners of every description, furnaces, heaters, parts, devices, accessories, machinery, tools, apparatus, novelties, metal products, fabricated goods, materials and fuel. The incorporators are: J. P. Hillman, W. B. Laughlin, A. A. Hillman, all of Kansas City.

The Allis Chalmers Manufacturing Co. has declared its regular quarterly dividend of 1 per cent on the common stock, payable Nov. 1.

The Binghamton Foundry and Machine Co., Binghamton, N. Y., is the name of the new company resulting from a merger of the Shapley & Wells foundry and the plant of McGill & Holford, both of that city. The new company has a capitalization of $250,000.

The Hupp Motor Car Corporation has declared its regular quarterly dividend of 2½ per cent on the common stock payable Nov. 1.

The Bridgeport Motor Co., Inc., manufacturer of marine motors and reduction gear equipment, etc., Bridgeport, Conn., has recently been reorganized. Henry H. Brautigan, general manager of the factory since 1900, has been made president and general manager of the new concern, and R. S. Hanover, of New York City, has been chosen secretary. The new company will have a capital stock of $100,000, and one of the new policy features will be the standardization of its product.

The Republic Iron and Steel Co. reports for the quarter ended Sept. 30, a deficit of $138,676, after taxes and charges. This compares with net profits of $86,382 in the previous quarter and a deficit of $1,398,410 in the third quarter of 1921. Unfilled orders on hand as of Sept. 30, of finished and semi-finished products totaled 199,431 tons, against 196,886 tons on June 30, and 69,577 tons on Sept. 30, 1921.

R. G. Haskins Co., manufacturer of flexible shaft equipment and portable tools, will move into larger quarters November 1 at 516 W. Monroe St., Chicago, Ill., which will give them increased store space for the display and demonstration of their machines as well as larger facilities for handling the routine of their business. A display room will be maintained where machines can be tested out on a great variety of actual operations.

The Western Iron Stores Co., Milwaukee, Wis., of which John Camm is president and general manager, is making extensive alterations and improvements to afford display facilities for greatly increased exhibit of machine tools and shop supplies.

American Radiator Co. has declared an extra dividend of 50 per cent in common stock on the common stock payable Dec. 30, to stock of record Dec. 15.

The Auburn Brass Foundry, Cranston, R. I., has recently been established by Axel W. and William Bergman, at 258 Wellington Ave., Cranston, to engage in the brass founders business.

The Connecticut Industries Co., Bridgeport, Conn., has recently been incorporated under the laws of Connecticut, to engage in the general manufacturing business, etc., with a capital stock of $100,000. The incorporators include Edward J. Kelly, Fairfield, Conn.; C. H. Sheehan, Bridgeport; and David S. Day, 886 Main Street, Bridgeport.

The Union Plane Co., New Britain, Conn., has recently been incorporated under the laws of Connecticut, to manufacture and deal in planes, tools, hardware, etc. The capital stock is $50,000, and the incorporators are: A. F. Corbin, 99 Vine St.; H. H. Wheeler, 28 Forest St.; and C. S. Newman; all of New Britain. Officers chosen are: president, A. F. Corbin; vice-president, C. S. Newman; secretary and treasurer, H. H. Wheeler.

The French Manufacturing Co., manufacturer of small tubing, etc., Waterbury, Conn., during the past week filed a certificate with the Secretary of the State of Connecticut, increasing the capital stock of the concern from $100,000 to $400,000, issuing 3,000 additional shares at $100 par value.

Personals

W. A. Creider has recently become affiliated with the Federal Machinery Sales Co., Chicago, and will cover the Milwaukee territory.

Frank Frisch has taken over the Milwaukee and Wisconsin territory, in addition to the Chicago district for the Courtland emery wheel.

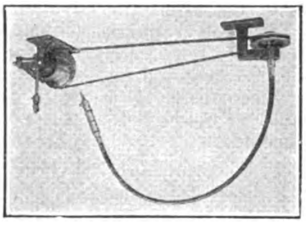
T. G. Remsen, formerly of Hill-Clark Co., has recently joined the organization of the Federal Machinery Sales Co., Chicago, Ill.

Louis W. Byrne, formerly with Burton Griffiths and Co., Ltd., New York

Condensed-Clipping Index of Equipment

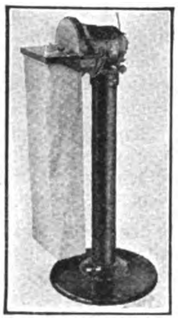
Patented Aug. 20, 1918

Flexible Shaft Outfit, Type NK48
Hergi Manufacturing Co., 250 Fifth St., Bridgeport, Conn.
"American Machinist," August 31, 1922



The outfit is intended primarily for driving screws. It is arranged for over-head mounting, but can be secured to the bench or wall. When the screw-driver is employed in the vertical position, the bracket is ordinarily mounted on the ceiling, but for horizontal work it is mounted on the walls. The counter-shaft is equipped with tight and loose pulleys and with a lever-operated belt shifter. A ball bearing swivel connection can be furnished for high speeds. The style of flexible shaft and hand piece needed can be provided. The finder sleeve can be furnished to fit the screw that is being driven.

Sander, Disk, Portable, Motor-Driven, 9-Inch
Syracuse Sander Manufacturing Co., Inc., Syracuse, N. Y.
"American Machinist," September 7, 1922

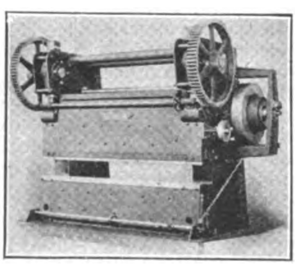


The machine can be fitted with garnet paper disks for sanding wood and grinding brass and aluminum, as well as with emery cloth for iron and steel. It can be connected to any convenient light socket, being furnished with a motor to suit the type of current available. The disk is driven directly by a ⅛ hp. G.E. enclosed motor running at 1,725 r.p.m. and controlled by a tumbler switch. The table is equipped with a graduated angle gage. The head is mounted on a pedestal by a swivel joint. A canvas bag is attached to the table for catching the dust thrown from the disk. Table: size, 5¼ x 10 in.; height, 38 in.; tilt, 45 deg. down, 15 deg. up.

Metal, Cutting, Non-Ferrous, "Diamond Alloy"
Kent-Owens Machine Co., Toledo, Ohio, maker;
P. H. Biggs, 1235 W. 9th St., Cleveland, Ohio, sales agent.
"American Machinist," September 7, 1922

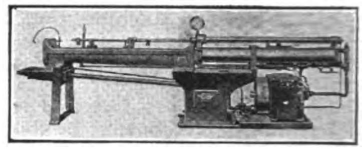
The metal is composed of chromium, molybdenum and tungsten, producing a hard, fine-grained, homogeneous alloy. It possesses an unusual degree of resistance to wear, and heat resisting quality, and is also non-magnetic. It can be cast in permanent molds into milling cutters, end mills and reamers; and requires only a grinding operation but no heat treatment. It can be cast around a tough steel center, or can be welded to steel. The "Super" toolholder holds the gradually tapered shank of the cutter bits made of the metal. It is made in nine different sizes, the section ranging from ⅜ x ¾ in. up to 1¼ x 2½ in. in size. With a single-point bit, the tool can be adapted as a right-hand, straight or left-hand tool.

Brake, Press, Power, All-Steel
Cincinnati Shaper Co., Cincinnati, Ohio
"American Machinist," September 14, 1922



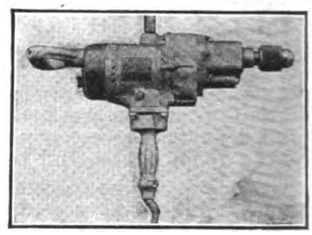
The strength and ease of operation are the chief features. The steel plates used for the frame and large members are electric welded in fabricating and assembling. The machine is made in four main pieces and, with the drive shaft and cross brace, has six parts to be assembled. With the open-side housings, bends can be made near the edge of the plate, utilizing the full length of the die-holding surface. The machine operates at a greater number of strokes per minute than customary. The flywheel is mounted on high-duty ball bearings with hardened races. The clutch is of the multiple-disk type operating in oil. The brake is built in capacities of from 80 to 600 tons and for working material from 10 gage to ¾ in. thick.

Broaching Machine, Hydraulic, High-Speed
Oilgear Co., Milwaukee, Wis.
"American Machinist," September 7, 1922



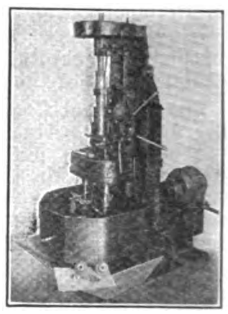
A standard type-MD, variable-delivery pump delivers a steady flow of oil to a double-acting cylinder, whose piston rod is connected to a sliding head. The speed of piston travel can be changed by changing the pump stroke. The speed of the return stroke is adjustable independently of the cutting stroke. Automatic stops can be set for any desired length of stroke. Reverse is operated by a small push-button or by automatic control. The machine is driven by vertical belt from a lineshaft or by a motor. Pulling capacity, 16,000 lb. Speed range, 48 to 360 in. per minute. Stroke, 56 in. Motor, 10 hp. Floor space, 16 ft. x 26 in. Weight, 2,900 pounds.

Drill, Electric, Portable, Reversible, "Independent"
Independent Pneumatic Tool Co., Chicago, Ill.
"American Machinist," September 7, 1922



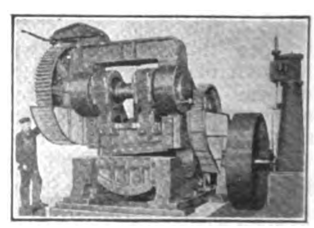
In the drill, the direction of motion is reversed mechanically. The reversing gear is equipped with a locking device which can be shifted to give three different motions. The locked constant forward motion is for drilling, reaming, stud driving, nut tightening and tube rolling; the locked constant reverse motion is for backing off nuts and backing out studs and tube rollers; and the neutral position allows the spindle to slip into the forward motion when the machine is pressed forward against the work and to slip into the reverse motion as the machine is withdrawn from the work. The reversing mechanism is adaptable to both electric and pneumatic tools.

Drilling Machine, Rotary-Table, Box-Column, 20-Inch
Rockford Drilling Machine Co., Rockford, Ill.
"American Machinist," September 7, 1922



The upright drilling machine is especially fitted for multiple-operation work on small parts. It is driven through a silent chain from an electric motor. The speed is changed by interchangeable pick-off gears and four changes of feed are provided by means of a gear box. A four-station rotary table having an indexing plunger worked by a treadle is applied to the regular table, and is indexed by hand after the locating plunger is pulled out of position. The table carries four two-jaw chucks, which are aligned under three work spindles, so that three operations are performed simultaneously.

Shear, Plate, 48-Inch
Reading Iron Co., Scott Foundry Dept., Reading, Pa.
"American Machinist," September 14, 1922



This shear has the capacity for 1-in. steel plate 48 in. wide. It is arranged for either steam engine or electric motor drive. The 11-in. diameter camshaft is equipped with an automatic releasing clutch. This clutch can be used either for stopping at every upstroke, thus leaving the shear open for inserting the plate, or else the machine can be operated continuously, at the will of the operator. Weight, 55,000 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

City, has been appointed sales manager of the Wilmarth and Morman Co., Grand Rapids, Mich., manufacturer of grinding machines.

H. L. SEVIN, of T. L. Dodd and Co., has been transferred from Chicago to Detroit, Michigan.

H. A. BRUCE, formerly connected with Packard Motor Car Co., and long identified with the machine tool industry, will represent the E. L. Essley Machinery Co. in the Michigan territory.

F. E. GEORGE, assistant superintendent of the Donora plant of the American Steel and Wire Co., has been appointed superintendent of that company's Farrell works.

LORENZ MAISEL, formerly interested in the Madison Tool and Stamping Works, has been appointed factory manager of the Allan-Diffenbaugh Wrench and Tool Co., Baraboo, Wis.

C. B. BURNS, formerly with the Fairbanks Co., has become associated with the E. L. Essley Machinery Co. in the Chicago district.

FRED M. DEVLIN has been appointed president of the Philadelphia Foundrymen's Association to complete the unexpired term of his father, the late Thomas Devlin.

RALPH WIRTH, formerly of the Toledo Press and Machine Co., and the Niagara Machine and Tool Works, will represent the E. L. Essley Machinery Co. as a special representative in its sheet metal machinery department.

CHARLES W. WILSON has resigned as vice-president and general manager of the Willys-Overland Co., Toledo, and returned to his duties as president of the Wilson Foundry and Machine Co., Pontiac, Mich.

SHERMAN A. HARDING has been appointed manager of sales of the Consolidated Machine Tool Corporation for the Pittsburgh district, in which district he has been serving as sales representative of the Betts Machine Co. for the past three years.

T. P. NEILSON, for some time past identified with the machine tool trade, has become associated with the E. L. Essley Machinery Co., in the Chicago district.

J. RUFUS CASSELL is now advertising manager of the New York Blue Print Paper Co., New York, N. Y. Mr. Cassell was formerly an advertising specialist for The John Service, Inc., New York City, and previous to that was connected with the Thomas Elevator Co., Chicago, Ill., and the Advertising Service Department of the McGraw-Hill Co., Inc., with headquarters in Chicago, Ill.

CAPT. ANDREW T. GRAHAM, naval inspector of machinery at Newport News, Va., has been ordered to Camden, N. J., as naval inspector of machinery.

COMMANDER FLETCHER L. SHEFFIELD has been assigned to duty as naval inspector of machinery at Newport News.

WALTER L. MILLER has been promoted to the position of chief of the foreign service division of the Bureau of Foreign and Domestic Commerce by Secretary of Commerce Hoover. The task of promoting the growth of American foreign trade, as well as supervising the activities of Government commercial agents in all foreign fields, will be under Mr. Miller's direction.

Obituary

JOSEPH BLACKWELL, one of the founders and principal owners of the Enterprise Machine Works, Los Angeles, Calif., died in that city October 6, aged 67 years. He was a native of New Brunswick, Canada, but for the past 30 years had resided on the Pacific coast.

SPENCER F. MOORE, chief engineer of the Collins Co., manufacturer of edge tools, Collinsville, Conn., died at his home in that place October 11, following an illness of a week due to an infection. Mr. Moore was born in Schenectady, N. Y., and was 36-years of age. He was formerly with the Westinghouse Machine and Electrical Co., and the Terry Steam Turbine Co., of Hartford, Conn.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Machinery and tools—Poland. Agency desired. Quotations, c. i. f. Danzig. Correspondence, German or French. Reference No. 3899.

Saw milling machinery—India. Purchase desired. Quotations. f. o. b. New York or San Francisco. Payment against documents. Reference No. 3921.

Machines for making soda straws—Canada. Purchase desired. Terms, cash. Reference No. 3951.

Machines for making pulp board pails—Canada. Purchase desired. Terms, cash. Reference No. 3954.

Apparatus for heating and pumping water to 50-room hotel—Cuba. Purchase desired. Quotations f.o.b. New York. Reference No. 3963.

Brick and tile machinery, architectural terra cotta machinery, and kilns for same—New Zealand. Purchase desired. Reference No. 3964.

Industrial transportation machinery, chemical plant equipment, structural steel, and boiler plant supplies.—Norway. Purchase desired. Quotations, f. o. b. New York or Philadelphia. Reference No. 3966.

Cotton boot and shoe lining cloths, of good weaves yet reasonably cheap, about 36 inches wide; also white shoe duck cloths in standard stock widths—Australia. Purchase and agency desired. Quotations, c. i. f. Sydney, Melbourne and Adelaide. Reference No. 3967.

One elevator for 50-room hotel—Cuba. Purchase desired. Quotations, f. o. b. New York. Reference No. 3968.

Tin plates of best quality—Italy. Agency desired. Quotations. c. i. f. Italian ports. Terms. cash. Reference No. 3970.

Woodworking machinery for small furniture manufacturers, such as circular saws, dimension saws, and benches for same, panel planers (buzzers), boring and sanding machines, disks sanders, cranking machines, band saws, spindle molders, etc., required by small furniture factories—Australia. Agency and purchase desired. Quotations, c. i. f. Port Adelaide. Terms. cash against documents. Reference No. 3975.

American raw cotton, cotton piece goods, cotton yarn, cotton waste, hardware, metals, sundries, etc.—India. Quotations, c. i. f. Bombay. Reference No. 3979.

Pipe fittings—Norway. Agency desired. Reference No. 3984.

Trade Catalogs

Inclinable Open Back Power Presses. The Niagara Machine and Tool Works, Buffalo, N. Y. This company has just issued a new publication, known as Bulletin No. 58, in which its complete line of inclinable open back presses are fully described with specifications and detailed illustrations.

Examples of Turning on the Lodge & Shipley Manufacturing Lathe. The Lodge & Shipley Machine Tool Co., Cincinnati, Ohio. A new publication of thirty-five pages has just been issued by this company which contains a study of problems in the economical and efficient production of small and medium sized parts. The forepart of the publication is given over to a detailed study of the company's manufacturing type of lathe with six carefully selected illustrations accompanying the description. Pages 10 to 30 are given over to detailed illustrations of lathe operations on various pieces of material both in the first and second stages of completion. The time required for each operation is set forth in each case. Pages 31 to 35 are given up to line drawings of various other kinds of parts with the time required for machining. The general arrangement of the publication is excellent, the photographs, line drawings and information showing clearly the possibilities of the company's manufacturing type of lathe.

Portable Electric Drills. The A. F. Way Co., Inc., Hartford, Conn. This company has just issued a folder setting forth the special features of the Way portable electric drill under the title, "Introducing a Way for Drilling."

Drill Presses. The Sigourney Tool Co., Hartford, Conn. This company has just issued a new catalog containing complete details of its line of plain bearing drill presses in one, two, three and four spindle types, as well as its bench type. The publication contains specifications on each type.

Thermit Locomotive Repairs.—The Metal and Thermit Corporation, New York, has issued the fourth edition of its Thermit Locomotive Pamphlet No. 21, which is of special interest to all railroad superintendents of motive power, general foremen, blacksmith foremen and thermit welders. The new pamphlet contains many revisions since the last edition was published, chief among which are instructions for applying important improvement in practice in Thermit welding which have been developed by exhaustive research. The drawings and instructions illustrating and describing making Thermit welds in various parts of locomotive frames and other locomotive and railroad equipment have been completely revised since the publication of the last edition to conform to the improved practice.

Forthcoming Meetings

American Manufacturers Export Association, annual convention, New York City, Oct. 25 and 26. Secretary, M. B. Dean, 160 Broadway, New York City.

American Trade Association Executives. Third annual meeting, Oct. 25, 26 and 27, 1922, at the Inn, Bucks Falls, Pa. (Delaware Water Gap).

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Blue annealed steel sheets, base size, $2.50@$2.85 as against $2.50@$2.75 per 100 lb. f.o.b. Pittsburgh; black, No. 28, $3.35@$3.75 as compared with $3.35@$3.50, one week ago. Tin quoted in New York warehouses at 35c. as against 34½c. per lb., last week. Discounts reduced two points on both black and galvanized wrought-steel pipe, on Pittsburgh basing card of Oct. 19.

Declines—Easier fuel situation reflected in downward trend of pig-iron prices. Structural shapes and mild steel bars quoted at an average price of $2 per 100 lb., Pittsburgh; small tonnages, however, still as high as $2.10@$2.15. Maximum on plates. $2.25 per 100 lb., f.o.b. mill.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	33.27
Southern Ohio No. 2	34.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	36.27
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	33.64
Virginia No. 2	37.17
Basic	29.50
Grey Forge	32.00
CHICAGO	
No. 2 Foundry local	31.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	33.50
Basic	30.00
Bessemer	32.50

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Detroit	10@12	8.0	3@4
New York	9@10	6.0	4.0
Cincinnati	9.0	6 0	5@5½
Cleveland	8.0	5.25	4.5
Chicago	6.0	5.0	4.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.85	4.19	3.70	4.00
No. 12	2.60@2.85	4.24	3.75	4.05
No. 14	2.70@2.90	4.29	3.80	4.10
No. 16	2.90@3.20	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.75	4.90	4.40	4.85
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11.	3.35@3.75	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.85	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.15	5.30	4.80	....
Nos. 22 and 24.	3.90@4.30	5.45	4.95	5.40
No. 26	4.05@4.45	5.60	5.10	5.55
No. 28	4.35@4.75	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	60%	47%	57½%	45½%	62½%	48½%
2½ to 6 in. steel lap welded.	57%	44%	55½%	42½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 5%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
3/32	8.00		12@13
⅛	6.50		11@12
3/16 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.75
Tin, 5-ton lots, New York	35.00
Lead (up to carlots), St. Louis.... 6.30; New York.	6.75@6.87½
Zinc (up to carlots), St. Louis..... 6.65; New York.....	7.37½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.00	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.50	10.25	.....
Solder (½ and ½), (caselots)	25.50	23.50	20.00
Babbitt metal (83% tin)	34.00	44.00	36.00
Babbitt metal (35% tin)	25.00	17.25	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	12.00	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3 00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.00	7.25
IC,	14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½	\$0.12	\$0.11½
Cotton waste, mixed, per b.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.97
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 9.65	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville... per net ton		10.50@11.00	
Coke, prompt foundry, Connellsville... per net ton		12.00@12.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$6.00	\$3.50	\$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	5.00	3.50
Washers, round plate; per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	\$5.00	\$3.90	\$3.35
Cone heads, ditto (net)	5.10	4.00	3.45
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in *EXTRA*	0.25	....	0.25
Less than 200 lb *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.55	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago—Chicago, Burlington & Quincy R.R., 547 West Jackson Blvd., L. N. Hopkins, Purch. Agt.—31 machine tools for Eola scrap reclamation yard near Aurora, Ill.

Ill., Decatur — Standard Mfg. Co., 422 City Title & Trust Bldg., (light generators, etc.)—spinning lathe, about 14 in. swing to spin 24 gauge sheet brass (used preferred).

Kan., Wichita—Biltwell Factories, 1414-17 South Washington St., (furniture manufacturers)—drill, press, lathe and other woodworking machinery.

Kan., Wichita—G. E. Osborn, 433 Wabash St.—small machine shop tools, grinder, wrenches, drill press, lathe and pulleys.

Ky., Somerset—Denton & Hamilton—16 to 18 in. shaper, Steptoe preferred (new or used).

La., New Orleans—The Cahn-Richards Tool & Supply Co., Inc., 709-711 Camp St., P. F. Richards, Vice-Pres.—lathes, drill presses, shapers, milling machines and all kinds of machinery.

Mass., Boston—Boston Sand & Gravel Co., 88 Broad St., P. F. Ayer, secy.—lathe, about 12 ft. long to take width of at least 20 in. (used).

Mich., Detroit—Dept. Purchases & Supplies, Marquette Bldg., G. J. Finn, Comr.—one portable motor driven cutting shear for Dept. Street Rys.

N. Y., Buffalo—D. Bunshaft, 55 Manchester Pl.—machinery, tools, etc., for proposed garage on Clinton St.

N. Y., Dunkirk—Leworthy Bros., Central Ave.—machinery, tools and mechanical equipment for garage and repair shop, to replace that which was destroyed by fire.

N. Y., Elmira—L. Clute, 215 Baldwin St.—machinery, tools and equipment for proposed garage and Ford service station at Horseheads.

O., Mansfield—The Ideal Electric & Mfg. Co.—24 in. shaper, milling machine and face grinder.

O., Spencer—Spencer Mfg. Co.—lathe, 3 drilling machines, 3 turret lathes, 2 milling machines.

Pa., Germantown (Phila. P. O.)—O. M. Dunn, Delmar and Morris Sts.—one power screw cutting machine.

Pa., Irvine—National Forge & Tool Co.—one 25 Colburn heavy duty drill press with compound table.

Pa., Pittsburgh—The National Tube Co., Frick Bldg.—10 or more heavy machine tools for Gary plant.

Pa., Pittsburgh—Pennsylvania R.R. Co., 1015 Pennsylvania Ave., W. G. Phelps, Purch. Agt.—receiving bids for 10 machine tools for Conway shops near Freedom.

Pa., Pittsburgh — Pittsburgh & Lake Erie R.R., South Smithfield St., C. M. Yohe, Purch. Agt.—90 in. wheel lathe, one 10 ton crane, four lathes, drill press, 24 in. shaper and grinder.

Pa., Scranton—J. Valverde, Walnut and Capouse St.—machinery and equipment for proposed $30,000 garage and repair shop.

Pa., Warren—R. Norris, c/o Warren Taxi Co.—repair shop equipment for proposed garage on Chestnut St.

Pa., Youngwood—The Robertshaw Mfg. Co.—equipment for proposed foundry and machine shop.

Va., Norfolk—The Virginian Ry. Co., T. Moore, Purch. Agt.—lathes and planers.

Va., Petersburg—American Spotless Co., 21 East Bank St., (manufacturer of street trash receptacles)—stamping machine for 20 gauge sheet iron.

Va., Petersburg—Andrews-Harris Boiler & Machine Co., A. Harris, Purch. Agt.—gear cutting attachment, Garvin head, also a 56 in. vertical boring machine.

Va., Petersburg—Blue Star Garage, 225 2nd St.—small lathe, drill press and cylinder grinder.

Va., Petersburg—The Crist Motor Co., 105 East Bank St.—small lathe.

Va., Petersburg—L. B. Curley, 426 Halifax St., (automobile repairs)—lathe and drill press.

Va., Petersburg—Lewis & Clayton, 116 West Bank St., E. M. Lewis, Purch. Agt.—electric drill.

Va., Petersburg—Peoples Motor Co., West Tabb St.—lathe and hand tools.

Va., Petersburg—Petersburg Fire Dept.—drill press, lathe and shaper.

Va., Petersburg—Smith & Temple, 27 and 37 East Bank St., (automobile repairs)—power press.

Va., Richmond—Auto Service Co., 1504 West Broad St., W. H. Wyatt, Purch. Agt.—lathe, drill press, emery grinding machine.

Wis., Ashford (Campbellsport P. O.)—J. Schill, (garage and repair shop)—automobile repair machinery, including drill press, gasoline storage tank and pump.

Wis., Chippewa Falls—The Chippewa Valley Auto Co., 16 River St., F. A. Bigler, Pres.—power and automobile repair machinery for proposed garage.

Wis., Milwaukee—Bahde Mfg. Co., 2621 Vine St., (manufacturer of patented mechanical articles), C. A. H. Bahde, Purch. Agt.—one No. 2 milling machine, 3 drill presses, one 14 in. and one 16 in. lathe, and one 24 in. shaper.

Wis., Montfort—O. Yerke—automobile repair machinery for proposed garage and repair shop.

Wis., Rhinelander—The Wisconsin Regrinding Co., A. P. Schneidewind, Sheboygan Falls, Pres.—power machinery and one 18 x 96 in. crankshaft grinder for proposed machine shop, here.

Wis., West Allis (Milwaukee P. O.)—Highway Garage & Service Co., Hawley and Beloit Rds., W. G. Schenk, Purch. Agt.—repair machinery, including lathe and drill press.

N. S., Truro—H. Johnson—iron foundry and machine shop equipment.

Ont., Toronto—The Ford Motor Co. of Canada, 672 Dupont St.—machine shop equipment, lathes, etc., for proposed motor factory on Danforth Ave.

Machinery Wanted

Colo., Aurora—W. A. Heller—complete newspaper equipment.

Conn., Bridgeport—The Frisbie Pie Co., 363 Kossuth St.—equipment for proposed bakery at Hartford.

Conn., Bridgeport—The Huber Ice Cream Co., 800 Seaview Ave.—ice making machinery for proposed addition to plant.

D. C., Wash.—Bureau of Yards and Docks Navy Dept., will soon receive bids for refrigerating and ice making equipment for plant at hospital, Pearl Harbor, T. H.

D. C., Washington—Bureau of Yards and Docks, Navy Dept. will receive bids until Nov. 15 for coal and ash handling equipment for hospital at Tupper Lake, N. Y.

Fla., New Smyrna—The Volusia Cypress Co.—machinery and equipment for proposed saw mill, planing mill and lumber plant.

Ill., Chicago—Hines Lumber Co., 2431 Lincoln St.—saw mill machinery.

Ill., Lakewood — P. Robinson — shoe finisher, motor direct, belting and shafting.

Ind., Alexandria—Ziegler Mfg. Co., (manufacturer of screw machine products, etc.)—machinery and equipment for $20,000 addition to factory.

Ind., Logansport—The Logansport Radiator & Equipment Co., J. F. Diggin, Pres.—machinery and equipment for proposed addition to factory, to triple present capacity.

Kan., Eskridge—C. W. Walker—saw mill, saws and belting.

Me., Sanford—The Sanford Mills, Inc., (woolen mills)—machinery for 4 story, 80 x 150 ft. and 6 story, 80 x 150 ft. additions to plant.

Mass., Boston — Arlington Press Corp., 112 Castle St.—job press, Chandler & Price, preferred, 10 x 5 in. or 12 x 18 in. (used).

Mass., Boston—The Merrimack Clay Products Co., 185 Devonshire St.—equipment for proposed plant for the manufacture of clay and hollow tile products at Plaistow, N. H.

Mass., Caryville—Taft Woolen Co.—machinery for addition to picker house.

Mass., Fall River—Fyans, Fraser & Blackway, 83 Anawan St., (textile machinery)—one continuous dyeing machine.

Mass., Malden—Yale Knitting Co. (manufacturer of union suits)—machinery for addition to mill.

Mass., Milford—The Charlescraft Press, 43 Exchange St., J. E. Barnes, Mgr.—printing machinery and equipment.

Mich., Ann Arbor—Parker Electric Mills—machinery and equipment for proposed $700,000 flour mill at Somerset, Ky.

Mich., Detroit—The Chevrolet Motor Co., West Grand Blvd.—equipment for making and assembling automobiles, bodies, enameling tanks, etc., for proposed factory at Buffalo.

Mich., Detroit—W. C. Dawson, 140 East Larned St.—complete equipment for woodworking machinery.

Mich., Detroit—The Pennsylvania R.R., 1368 Penobscot Bldg.—machine equipment for proposed engine house on 19th St.

Mich., Detroit—Ternstedt Mfg. Co., Artillery and Muster Aves.—miscellaneous machine equipment for addition to plant, for the manufacture and finishing of automobile hardware.

Minn., Bluffton—Bluffton Creamery Assn., H. G. Imdreke, Secy.—one 1,000 lb. churn, two 300 gal. cream ripeners, one 30 gal. starter can, one 24 bottle steam tester, one 30 gal. weigh can, one Torsion test scales, one wash sink, one 20 hp. horizontal boiler, one 15 hp. horizontal center crank engine and about 40 ft. of line shafting with hangers and pulleys.

Minn., Minneapolis—The Ives Ice Cream Co., 2nd and University Aves., S. E., A. H. Ives, Pres.—ice cream making equipment, including freezers, tanks, can washers, etc., for proposed addition to plant.

Miss., McComb—McComb Ice Co., V. G. Conner, Supt.—refrigerating machinery and equipment for proposed ice plant.

Mo., Kansas City—K. Prather, 302 Brotherhood Bldg.—tinner's tools, hand forming brake, rolls and compressor.

Mo., St. Louis—The Plateless Engraving Co., Victoria Bldg.—23 in. power paper cutter.

N. J., Camden—Camden Pottery Co., Mt. Vernon and Orchard Sts.—grinding machine, electric kilns and furnaces.

N. Y., Big Flats—H. B. Thomas—one concrete block making machine.

N. Y., Binghamton—Bd. Educ.—vocational equipment for proposed $350,000 school on Stan Ave.

N. Y., Elmira—M. Hutchison, 801 Winsor Ave.—one paper baling machine.

N. Y., Geneva—A. E. Meyers—sand digger and loading machine, gasoline driven (clamshell and boom type preferred).

N. Y., Penn Yan—Keuka Lake Ice Co.—machinery and equipment for conveying and handling ice, for proposed ice house.

N. Y., Rochester—Brighton Place Dairy Co., 1757 East Ave., refrigeration machinery and equipment for proposed plant.

N. Y., Rochester—A. W. Hopeman & Son, 575 Lyell Ave.—machinery and equipment for proposed fur tannery.

O., Caldwell—The Caldwell Collieries Co.—machinery and equipment for generating and hoisting plant at the Florence Mine, to replace that which was destroyed by fire.

O., Cleveland — Western Newspaper Union, 1279 West 3rd St.—model No. 1 linotype machine.

O., Columbus—The Columbus Auto Spring Co., 205 East Capital St., J. J. Puskar, Purch. Agt.—emery stand and blowers.

O., Columbus — Columbus Consumers' Supply Co., 315 North 4th St., (building supplies), R. H. Miller, Genl. Mgr.—full line of loading and unloading machinery for new branch yard at 1154 West Broad St.

O., Findlay—The Adam Axle Co.—$40,000 to $50,000 worth of machinery for proposed addition.

O., Youngstown—Commercial Shearing & Stamping Co., G. Ohl, Secy.—$30,000 worth of machinery.

Okla., Atoka—Atoka Press—newspaper equipment (used).

Okla., Tecumseh—C. Polaski—ice making machinery.

Okla., Tulsa—The National Refining Co.—machinery and equipment for 2 proposed electrical pumping plants.

Ore., Talent — The Talent Lumber Co., P. J. Neff, Medford, Ore., Secy.—machinery for proposed sawmill, here, 30,000 ft. capacity.

Pa., Ardmore—J. H. Clarke (contractor)—24 in. band saw with counter shafts, etc.

Pa., Bloomsburg—The Bloomsburg Paper Co.—machinery and equipment for proposed plant, to replace that which was destroyed by fire.

Pa., Canton—G. M. Coons Co.—additional machinery and equipment for sand and gravel plant.

Pa., Mahaffey—The Times—six column quarto newspaper press (used).

Pa., Mercer—Mercer Refining Co., c/o W. C. Hastings, Treas., Franklin, Pa., (oil refining)—pulleys and shafting machinery, hangers, belting chain and belt conveying machinery.

Pa., Phila.—The Adelphia Mfg. & Plating Co., Belgrade and Orthodox Sts.—additional foundry equipment for iron and brass.

Pa., Phila.—W. Boyle, 1141 Winston St. (printer)—one large paper cutter and one numbering machine.

Pa., Phila.—The Cocoanut Specialty Co., 1214 North Crese St. (manufacturer of confectionery)—shredding machinery, steam vats, packing machines, etc.

Pa., Phila.—Presbyterian Hospital, 39th St. and Powelton Ave.—complete laundry machinery and equipment.

Pa., Pittsburgh—M. K. Frank, 917 Frick Bldg., (iron and steel scrap)—1½ or 2 ton traveling electric crane to travel on single rail (new or used).

Pa., Pittsburgh—The Koppers Co., Union Arcade—air operated crane for the by-product plant of the Carnegie Steel Co. at Clairton.

Pa., Sharon—Maniscalco New Power System Co., M. & M. Bank Bldg.—special machinery for the manufacture of patented self generating electric motors.

Pa., Wallingford—The Sackville Mills Co. (manufacturer of textiles), M. E. Sack, Purch. Agt.—30 in. cloth folder machine.

Pa., Wilkes-Barre — Paradise Sweets, Inc., 24 West Union St., L. K. Salsburg, Dir.—candy and ice cream making equipment.

S. C., Conway — Horry Herald, H. H. Woodward, Purch. Agt.—six column quarto newspaper press.

S. C., Georgetown — The Times—30 in. standard paper cutter.

Tenn., Knoxville — The Appalachian Marble Co., Middlebrook Pk.—single head channeling machine.

Va., East Radford—The Journal—seven column chases, reglet case, leads, slugs and folder for newspaper.

Va., Glenallen — J. Frank Darling Co., (planing mill), J. F. Darling, Purch. Agt.—10 in. moulder and double service planer.

Va., Petersburg—J. E. Collier, 416 Short Market St.—nickel plating outfit.

Va., Petersburg—Nash Bros., 108 West Bank St.—power emery machine.

Va., Petersburg—Petersburg Builders Supply Co., 222 North Market St., A. Strailman, Purch. Agt.—planer.

Va., Richmond—Donnati Fiber Box Co., 3210 Williamsburg Ave.—machinery for the manufacture of fiber boxes, to replace that which was destroyed by fire.

Va., Richmond — R. E. Piper, 1522 West Broad St. (cornices and roofing)—cornice brake and large power shears.

Wash., Centralia — The H. H. Martin Lumber Co., H. H. Martin, Pres. and Genl. Mgr.—complete equipment for 100,000 ft. capacity saw and planing mill, prefer electrical drive for individual machines, logs up to 100 and 120 in. in diameter, must be handled by main saw and carriage.

W. Va., Princeton—T. M. Fry—ice cream machinery (used).

Wis., Green Bay—Knowlton Candy Co., c/o J. W. McNevins, 721 South Quincy St.—candy making machinery.

Wis., Madison—The Meyer Printing Co., 117 South Webster St.—printing presses, power driven, and equipment for addition to printing plant.

Wis., Madison—The State Bd. of Control, M. J. Tappins, Secy.—ice machine for proposed cold storage plant at Delevan.

Wis., Madison—Valvoline Oil Co., 815 East Main St.—oil storage tanks, pumps, etc., for proposed filling station.

Wis., Milwaukee—C. G. Forster, 62 27th St.—planing mill machinery.

Wis., Milwaukee—Northwestern Barrel Co., 76 South Bay St., (manufacturer of boxes and barrels), T. J. Verden, Purch. Agt.—2 or 3 band saws.

Wis., New Holstein—The New Holstein Canning Co., A. T. Hipke, Secy.—machinery for proposed canning factory.

Wis., North Milwaukee—E. Korth, Route 5, (carpenter and millworker)—band saw, about 32 in.

Wis., Oshkosh—R. A. Lutz, 1270 Knapp St.—machinery and equipment for new crushed stone plant.

Wis., Oshkosh—The Williams-Loper Co., 213 Harrison St.—special machinery for the manufacture of free-air stands, etc., for garages.

Wis., Sheboygan—The Northern Furniture Co., South Water St.—machinery, including power machinery, for proposed furniture factory at Tacoma, Wash.

Wis., West Bend—The West Bend Concrete Products Co.—machinery, including some power machinery, for the manufacture of drain tile and concrete products for proposed factory.

B. C. Powell River—The Powell River Co., Ltd.—machinery for proposed paper mill.

Ont., Kincardine—Kincardine Salt Wks.—$30,000 worth of equipment, piping, evaporators and special equipment for handling salt.

Que., Montreal—Dominion Steel Co., Canada Cement Bldg—$50,000 worth of equipment, to increase daily output of fence material from 60 to 120 ton, for Besco Wire mill at Sidney, N. S.

Metal Working Shops

Calif., San Francisco—J. Madison, 112 Market St., awarded the contract for the construction of a 3 story, factory on Harrison St. Pacific Meter Wks., 1123 Harrison St., lessee. Estimated cost $29,950. Noted Oct. 19.

Calif., San Francisco—A. J. Pahl, 37 Stevenson St., awarded the contract for the construction of a 2 story machine shop on Howard St. near 4th St. Estimated cost $25,000.

Calif., Stockton—H. S. Dawson, c/o G. Allen, Archt., 37 South Aurora St., is having plans prepared for the construction of a 3 story garage on North California and Oak Sts. Estimated cost $50,000.

Conn., New Britain—Landers, Frary & Clark, Commercial St., awarded the contract for the construction of a 6 story addition to its hardware and cutlery factory on Stanley St. Estimated cost $75,000.

Conn., New Haven—H. B. Ives & Co., 5 Artizan St., awarded the contract for the construction of a 4 story, 40 x 40 ft. and a 1 story, 30 x 80 ft. wing addition to its hardware factory. Cost from $35,000 to $40,000.

Conn., Norwalk—C. J. Mintz, 92 Washington St., South Norwalk, awarded the contract for the construction of a 1 story, 85 x 140 ft. garage on West Ave., here. Estimated cost $40,000.

Ind., Fort Wayne—The General Electric Co., Bway and Wall St., will build a 1 story, 150 x 150 ft. tank shop and garage. Estimated cost $30,000. Noted Oct. 12.

Ind., Lebanon—Cline & Hicks are having plans prepared for the construction of a 1 story, 60 x 100 ft., 40 x 40 ft. and 40 x 60 ft. paint and machine shops. Estimated cost $40,000. Private plans.

Ind., Lebanon—The Indestructible Wheel Co. is having plans prepared for the construction of a 2 story, 100 x 160 ft. addition to its factory for the manufacture of wire wheels. Estimated cost $60,000. Private plans.

Mass., Cambridge — The Auto Truck & Wagon Co., 141 First St., will soon award the contract for the construction of a 1 story, 85 x 100 ft. automobile body factory. Estimated cost $30,000. Private plans.

Mass., East Boston (Boston P. O.)—The Hersey Mfg. Co., 314 West 2nd St., awarded the contract for the construction of a 2 story plant for the manufacture of special machinery on E St. Estimated cost $25,000.

Mass., Somerville—J. W. Knowles, 660 Bway., awarded the contract for the construction of a 1 story, 90 x 150 ft. garage, etc., on Highland Ave. and Eastman Rd. Estimated cost $40,000.

Mass., Worcester—A. A. Wheeler, 159-163 Mechanic St., awarded the contract for the construction of a 2 story garage and service station. Estimated cost $100,000.

Mich., Detroit—The Pennsylvania R.R., 1368 Penobscot Bldg., is having plans prepared for the construction of a 1 story, engine and round house, including turntable, water tower, coaling station and handling equipment, on 19th St. B. V. Sommerville, 1368 Penobscot Bldg., Engr.

N. Y., Buffalo—D. Bunshaft, 55 Manchester Pl., plans to build a 1 and 2 story, 66 x 100 ft. garage on Clinton St. Architect not announced.

N. Y., Buffalo—The Chevrolet Motor Co., Buffalo, and West Grand Blvd., Detroit, Mich., is having plans prepared for the construction of a 1 and 2 story, 338 x 900 ft. automobile factory and loading platform on East Delevan Ave., here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

N. Y., Buffalo—The Empire Drawn Steel Corp., 1133 Marine Bank Bldg., is having plans prepared for the construction of a 1 story, 70 x 450 ft. cold drawn steel factory on Germania St., capacity 36,000 tons annually. Estimated cost $100,000. Harding & Crea, White Bldg., Engrs.

N. Y., Buffalo—P. M. McGroff, Montreal, Que., plans to build a steel wire factory, here. Estimated cost $1,000,000. Architect not selected.

N. Y., New York—W. F. Harving, c/o J. P. Whiskeman, Engr. and Archt., 153 East 40th St., will build a 1 story, 135 x 150 ft. garage on Webster Ave. Estimated cost $75,000.

N. Y., New York—S. M. DePasquale, c/o S. J. Kessler, Archt. and Engr., 529 Courtlandt Ave., will build a 2 story garage on Webster Ave. and Moshula Parkway. Estimated cost $120,000

O., Cleveland—The Denby Wire & Iron Co., 5119 Euclid Ave., has had plans prepared for the construction of a 1 story, 40 x 105 ft. factory at 3005 East 81st St. Estimated cost $40,000. H. Denby, owner.

O., Cleveland—F. Svoboda, 5377 Bway., awarded the contract for the construction of a 2 story, 45 x 139 ft. garage on Bway. and Mumford Ave. Estimated cost $60,000. Peck & Horton (Ford dealers), 2261 East 14th St., lessee. Noted Sept. 21.

O., Findlay—The Adam Axle Co. plans to build an 80 x 200 ft. addition to its factory. Cost will exceed $50,000.

O., Salem—The Deming Co., Etna St., manufacturer of pumps, awarded the contract for the construction of a 1 story foundry. Estimated cost $50,000.

Pa., Enola—The Pennsylvania R.R., Broad St. Sta., Phila., awarded the contract for the construction of a 100 x 620 ft., car building shop, and four 1 story 16 x 31 ft., 16 x 61 ft., 100 x 424 ft. and 42 x 402 ft. buildings, for repairing cars, etc., here.

Pa., Oil City—The Oil City Boiler Wks., 351 Seneca St., awarded the contract for the construction of a 1 story, 60 x 75 ft. addition to its boiler plant.

Pa., Phila.—C. Kahn, Morris Bldg., awarded the contract for the construction of a 2 story, 21 x 200 ft. sales and service building at 1618 North Broad St. Estimated cost $75,000.

Pa., Phila.—The Nash Motor Co., 901 North Broad St., awarded the contract for the construction of a 5 story, 75 x 160 ft. sales and service station on Broad and Thompson Sts. Estimated cost $300,000.

Pa., Pitcairn—The Pennsylvania R.R., Broad St. Sta., Phila., awarded the contract for the construction of a 13 x 25 ft. oil house, and 100 x 620 ft., 16 x 31 ft. 16 x 61 ft., 100 x 424 ft., and 42 x 202 ft. buildings for constructing and repairing cars, etc., all 1 story, here. Noted Oct. 5.

Pa., Pittsburgh—The Harmony Creamery Co., 407 Liberty Ave., awarded the contract for the construction of a 2 story, 56 x 115 ft. garage on Reedsdale St. Estimated cost $40,000.

Pa., Pittsburgh—The Jones & Laughlin Steel Co., 3rd Ave. and Ross St., will build a 1 story, 100 x 150 ft. addition to its polishing plant on 2nd Ave. (Hazelwood). Estimated cost $25,000.

Pa., Pittsburgh — The Webster Ave. Garage Co., c/o A. Ricordino, 1010 Webster Ave., awarded the contract for the construction of a 2 story, 40 x 110 ft. garage. Estimated cost $40,000.

Pa., Youngwood—The Robertshaw Mfg. Co. is receiving bids for the construction of a 1 story, 30 x 65 ft. and 110 x 130 ft. foundry and machine shop. Amer. City Eng. Co., Peoples Bank Bldg., Pittsburgh, Archts.

R. I., Providence—The Olneyville Realty Co., Inc., 18 Plainfield St., awarded the contract for the construction of a 1 story, 60 x 175 ft. garage, etc. Estimated cost $40,000. Noted Oct. 5.

Tenn., Memphis—The Louisville & Nashville R.R., Louisville, Ky., plans new round house near here, also switch tracks and car repair shops near coaling plant, at Leewood. Estimated cost $250,000. A. B. Scates, supt. Memphis div. W. H. Courtenay, Louisville, Ch. Engr.

Wis., Chippewa Falls — The Chippewa Valley Auto Co., 16 River St., is receiving bids for the construction of a 2 story, 124 x 130 ft. garage. Estimated cost $75,000. F. A. Bigler, Pres. E. J. Hancock, Laycock Bldg., Eau Claire, Archt.

Wis., Montfort—O. Yerke will build a 1 story, 50 x 60 ft. garage and repair shop. Estimated cost $40,000.

Wis., Oshkosh—The Williams-Loper Co., 213 Harrison St., awarded the contract for the construction of a 2 story, 45 x 80 ft. factory for the manufacture of air pressure tanks, etc., for garages. Estimated cost $15,000.

Wis., Milwaukee—F. Kraning, 1147 Forest Home Ave., awarded the contract for the construction of a 2 story, 30 x 80 ft. addition to garage. Estimated cost $40,000. Noted Oct. 12.

Wis., Milwaukee—Leenhouts & Guthrie, Archts., 424 Jefferson St., are receiving bids for the construction of a 1 story, 120 x 120 ft. garage, for the Luick Ice Cream Co., 183 Ogden Ave. Estimated cost $60,000. Noted Oct. 5.

Wis., Milwaukee—C. F. Ringer & Son, Archts., 432 Bway., are receiving bids for the construction of a 1 story, 50 x 150 ft. garage on 9th St., for the O. Jaeger Baking Co., 914 Central Ave. Estimated cost $40,000.

Wis., Rhinelander — The Wisconsin Regrinding Co. will build a 1 story, 50 x 90 ft. machine shop, here. Estimated cost $40,000. A. P. Schneidewind, Sheboygan Falls, Pres. Private plans. Noted Oct. 5.

Ont., Toronto—The Ford Motor Co. of Canada, 672 Dupont St., plans to build a 1 story, 350 x 650 ft. motor factory on Danforth Ave. Estimated cost $500,000.

General Manufacturing

Calif., Pittsburg—The Pioneer Rubber Mills awarded the contract for the construction of a factory. Estimated cost $141,000. Noted June 29.

Calif., San Francisco—C. E. Lewis, 306 Sacramento St., awarded the contract for the construction of a 2 story, 25 x 120 ft. glove factory on Folsom St. Estimated cost $6,000. Noted Oct. 19.

Calif., San Francisco—MacDonald & Kahn, 130 Montgomery St., awarded the contract for the construction of a 3 story, 50 x 182 x 218 x 275 ft. office, studio and workshop building on Pierce, Steiner, Turk and Eddy Sts. Foster & Kleiser Co., billboard erectors and advertising experts, 287 Valencia St., lessee.

Calif., Tracy—The General Milk Co., of California, c/o A. J. Mazurette, Archt., 1002 H St., Modesto, will soon receive bids for the construction of a condensary plant. Estimated cost $75,000. Noted March 23.

Colo., White River (Meeker P. O.)—The Rio Blanco Carbon Co., 818 Symes Bldg., Denver, is having plans prepared for the construction of a 1 story, 12 x 16 ft. and 14 x 110 ft. and a 2 story, 20 x 40 ft. plant for the manufacture of carbon black, here. Estimated cost $60,000. O. D. Horton, 714 Commerce Bldg., Erie, Pa., Engr.

Conn., Bridgeport—The Huber Ice Cream Co., 800 Seaview Ave., awarded the contract for the construction of a 3 story, 60 x 102 ft. addition to its ice cream factory. Estimated cost $100,000. Noted Oct. 19.

Conn, Hartford—The Frisbie Pie Co., 363 Kossuth St., Bridgeport, is receiving bids for the construction of a 2 story, 90 x 100 ft. bakery and warehouse, including portion for garage and washroom, here. Estimated cost $50,000. Private plans.

Conn., Middletown—M. Bornstein & Sons, 40 Gray St., Paterson, N. J., are having plans prepared for the construction of a 1 story, 60 x 200 ft. addition to their silk mill, here. Estimated cost $40,000. Private plans.

Conn., Naugatuck—The Goodyear India Rubber Glove Co., 58 Maple St., awarded the contract for the construction of a 3 story, 60 x 110 ft. addition to its factory, for the manufacture of rubber goods. Estimated cost $75,000.

Conn., Waterford—J. and G. H. Bathgate, Jordan Mill, awarded the contract for the construction of a 2 story, 40 x 141 ft. addition to its textile mill. Estimated cost $50,000.

Fla., New Smyrna—The Volusia Cypress Co. plans to build a saw mill, planing mill and lumber plant. Estimated cost $100,000.

Ill., Chicago — E. E. McClellan, Archt., 7441 Cottage Grove Ave., is receiving bids for the construction of a 1 and 2 story, 200 x 200 ft. addition to ice cream factory, for the Victory Ice & Ice Cream Co., 15th St. and Keeler Ave. Estimated cost $100,000.

Ill., Chicago—The McDonald Loose Leaf Co., 638 Federal St., awarded the contract for the construction of a 1 story, 95 x 125 ft. factory at 1809-17 Summerdale Ave. Estimated cost $50,000. Noted Sept. 14.

Ind., Bedford—The Indiana Quarries Co. awarded the contract for the construction of a 1 story, 400 x 600 ft. stone mill. Estimated cost $400,000. Noted Sept. 14.

Ind., Elkhart—The Curtain Supply Co. awarded the contract for the construction of a 1 story, 172 x 400 ft. curtain factory. Estimated cost $100,000. Noted Oct. 12.

Ind., Fort Wayne—The Wayne Oil Tank & Pump Co., Anthony Hotel, awarded the contract for the construction of a 1 story, 50 x 320 ft. paint factory addition. Estimated cost $40,000. Noted Oct. 12.

Mass., Gardner—G. E. O'Hearn, 92 Oak St., awarded the contract for the construction of a 1 story, 50 x 210 ft. factory, for the manufacture of novelties, on Parker St. Estimated cost $40,000.

Mass., Worcester—The Queensbury Mills, Inc., Quinsigamono Ave., plans to build several large additions to its yarn plant. Architect not selected.

Minn., Minneapolis—The Ives Ice Cream Co., 2nd and University Aves., S. E., awarded the contract for the construction of a 3 story, 40 x 76 x 117 ft. addition, and for adding 3rd story to present 41 x 117 ft. building. Estimated cost $74,000. A. H. Ives, Pres. Noted July 13.

N. H., Plaistow — The Merrimack Clay Products Co., 185 Devonshire St., Boston, will soon award the contract for the construction of a 1 and 2 story, 200 x 600 ft. plant for the manufacture of clay and hollow tile products, here. Estimated cost $200,000. Morse & Chase, 25 Washington Sq., Haverhill, Mass., Archts. Noted June 29.

N. Y., Brooklyn—The Brooklyn Daily Eagle, Eagle Bldg., awarded the contract for the construction of a 6 story, 83 x 111 ft. publishing plant on Adams and Johnson Sts.

N. Y., Rochester—A. W. Hopeman & Son, 575 Lyell Ave., plan to build a fur tannery. Estimated cost $16,000. Architect not announced.

O., Caldwell—The Caldwell Collieries Co. plans to rebuild its generating and hoisting plant at the Florence Mine, which was destroyed by fire. Estimated cost $70,000.

O., Euclid—The Municipal Realty Co., c/o A. Bloom, Supt. of Constr., Hanna Bldg., will build a 1 story warehouse and lumber mill on Bliss Rd. and St. Clair Ave. Estimated cost $150,000. Private plans.

Ore., Talent — The Talent Lumber Co. plans to build a saw mill, 30,000 ft. capacity. P. J. Neff, Medford, Secy.

Pa., Bloomsburg—The Bloomsburg Paper Co. plans to rebuild its paper factory, which was destroyed by fire. Estimated cost $75,000.

Pa., Phila.—The Cocoanut Specialty Co., 1214 North Crese St., will soon receive bids for the construction of a 4 and 6 story, 80 x 180 ft. factory, for the manufacture of cocoanut specialties, at Wayne Junction. Estimated cost $250,000. Lachman & Murphy, Drexel Bldg., Archts.

Pa., Phila.—A. A. Zimmerman, Archt., 85 9th Ave., New York City, will receive bids Nov. 1 for the construction of an 8 story, 150 x 256 ft. bakery for the National Biscuit Co., Broad St. and Glenwood Ave., here. Estimated cost $500,000.

Pa., Reading—The Central Abattoir Co., Chestnut St., awarded the contract for the construction of a 3 story packing plant. Estimated cost $175,000. Noted July 20.

Pa., Rikers (Punxsutawney P. O.)—The Buffalo, Rochester & Pittsburgh R.R., 20 State St., Rochester, N. Y., awarded the contract for the construction of a coaling station, 1,200 ton capacity, here.

Pa., Sharon—The Valley Packing & Provision Co., 114 Franklin St., awarded the contract for the construction of a 2 story, 54 x 106 ft. addition to its packing plant. Cost will exceed $10,000. Noted June 29.

R. I., Woonsocket — The Glenbrook Worsted Mills, Mason St., awarded the contract for the construction of a 1 story, 30 x 125 ft. addition to its plant. Estimated cost $25,000.

Tenn., Carthage — The Carthage Spoke Co. increased its capital stock from $50,000 to $100,000 for additions, machinery and improvements to plant. A. Bilbrey, Supt.

Tenn., Memphis—Clover Farm Dairy Co., 789 Union Ave., is building a 3 story creamery and ice cream factory on Orleans and Beale Sts. Estimated cost $80,000.

Tex., Deweyville — Peavy-Moore Lumber Co. plans to rebuild saw and lumber mill to replace the one which was recently destroyed by fire. Estimated cost $200,000.

Va., Richmond—The Fibre Board Container Co., 3200 Williamsburg Ave., manufacturer of boxes, awarded the contract for the construction of a 3 story, 50 x 150 ft. plant to replace the one which was recently destroyed by fire. Estimated cost $20,000.

Wash., Tonasket—The Standard Oil Co., Realty Bldg., Spokane, has had plans prepared for the construction of a 1 story, 40 x 60 ft. distributing station, including tanks, etc., here. Estimated cost $20,000. C. E. McKay, Realty Bldg., Spokane, Engr.

W. Va., Clarksburg—The Clarksburg Exponent Publishing Co. awarded the contract for the construction of a 2 story, 62 x 150 ft. printing plant on Hewes St. Estimated cost $50,000.

W. Va., Princeton—The Princeton Hosiery Mills Co. plans to build a 2 story, 50 x 150 ft. hosiery mill. Private plans.

W. Va., Wellsburg—The Hammond Bag & Paper Co., Box 467, awarded the contract for the construction of a 1 story, 125 x 350 ft. paper mill.

W. Va., Wheeling—The Interstate Oxygen Co. awarded the contract for the construction of a 1 story, 100 x 150 ft. oxygen factory, on 44th and Eoff Sts. Estimated cost $50,000.

W. Va., Wheeling—The Wheeling Box Co., 3007 Chapline St., will build a 2 story, 40 x 175 ft. addition to its box factory. Estimated cost $10,000.

Wis., Clyman — The Reeseville Canning Co., Reeseville, will build a vegetable canning plant, consisting of a 70 x 162 ft. warehouse, a 70 x 120 ft. machine room, a 64 x 90 ft. boiler house, all one story, also miscellaneous sheds. Estimated cost $75,000. Noted Oct. 12.

Wis., Granville—The Rauschenberger Tire Co., Akron, O., plans to build a 3 story, 150 x 175 ft. factory here, for the manufacture of auto tires. Estimated cost $150,000. Architect not selected.

Wis., Green Bay—The Fort Howard Paper Co., South State St., awarded the contract for the construction of a 3 story, 100 x 140 ft. paper finishing plant. Estimated cost $100,000.

Wis., Horicon—The Allen-Spiegel Shoe Co., Belgium, plans to build a 2-3 story, 60 x 150 ft. shoe factory, here. E. W. Allen, Mgr. Architect not selected.

Wis., Menomonee Falls—Pure Milk Co., c/o A. E. Johnson, Pres., 722 41st St., Milwaukee, awarded the contract for a 1 story, 42 x 80 ft. milk bottling plant, here. Estimated cost $20,000.

Wis., Milton—The Burdick Cabinet Co. awarded the contract for the construction of a 1 story, 80 x 160 ft. factory addition. Estimated cost $45,000. Noted Sept. 21.

Wis., Milwaukee—Waukesha Dairy Co., 342 6th St., awarded the contract for the construction of a 4 story, 50 x 78 ft. addition to its dairy. Estimated cost $50,000.

Wis., Park Falls—The Flambeau Paper Co. awarded the contract for the construction of a 2 story, 50 x 95 ft. pulp mill. Estimated cost $100,000. G. Waldo, Mgr.

Wis., South Milwaukee—The Burnham Bros. Brick Co., 68 Wisconsin St., awarded the contract for the construction of a 1 story, 85 x 100 ft. dryer plant, on Chicago Rd. Will build a machine building, power house and brick burning building in near future. Noted Dec. 15, 1921.

Ont., Hanover—The Peninsular Cord Tire Co. plans to build a new factory. Estimated cost $100,000. W. A. Oakley, Mgr.

Ont., London—The Corrugated Carton Co., York and Glenbe Sts., is having plans prepared for the construction of a factory. Estimated cost $60,000.

Ont., St. Thomas—The City Gas Comn., will vote on a bylaw Dec. 1 for the rebuilding of civic gas plant and the installing of vertical retorts. Estimated cost $100,000. W. A. McIntyre, City Hall, Chn. W. Miller, City Hall, Engr. Noted Sept. 14.

Ont., Sault Ste. Marie—F. W. Reese and T. J. Wilcox plan to build a gas plant. Estimated cost $200,000.

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What's Wrong with the Railroad Shops?

Railroad Shop Practice Different from that of Other Machine Shops—Mechanical Departments Badly Handicapped by Poor Equipment—Lack of Contact with Other Shops

THERE ARE TWO kinds of machine shops, ordinary machine shops and railroad shops. If a man had worked in shops where heavy machinery was made, in shops where typewriters were manufactured, in machine-tool shops where tools were built in moderate quantities, in high-production automobile shops, he might think he knew the machine shop. He might have handled work where a split sixty-fourth was close enough and other work where a tenth of a thousandth was a common unit, and yet he would not know the railroad shop which is a law unto itself and different from other shops in almost every particular. Whether this needs to be so is a question, but that it is so is obvious at the first visit to one of these shops and becomes increasingly evident when one visits a number of them.

Not only is the practice of the average railroad shop different from established practice in good machine shops, but it is also unlike that of other railroad shops so that the first impression, that there must be conditions here which make a different practice necessary, is swept away. One finds good machine-shop practice in the railroad shops in spots, a bright spot in this shop, another one in that shop, still another in some other shop. All the bright spots are there if one takes all the railroad shops together, but there are very few in any single shop, leaving untold room for improvement.

The observations made by the *American Machinist* representatives who visited a number of railroad shops covered such items as buildings, equipment (machinery), tools, methods and control. Due to the fact that in some of the shops practically the entire working force was new, it was thought that due allowance would have to be made for the greenness of the hands, but conversation with the management brought out the fact that these new men were an agreeable surprise in that they did much better than was expected and in many cases produced more than the old hands who had gone out on strike. Railroad officials further stated that but a short time would be required to bring the entire force up to, and possibly above, the pre-strike level. Apparently this does away with the old idea that the railroad shop man is different from any other shop man, that his experience must be along different lines, and that the practice in a railroad shop must therefore be different from that in any other shop.

This idea that the railroad mechanic is an entirely distinct species was held and perhaps *is* held quite commonly. It was the basis for the belief of the strikers that they could not be replaced. Of course the work in a locomotive repair shop is different from that in the shop where cash registers or automobiles are made. A certain amount of special knowledge and experience is needed in any shop to make things run smoothly. On the other hand, there is in all shops a great deal of knowledge applied every day which is not special to that particular establishment but which is the common knowledge of well-trained mechanics and engineers. Whether a piece of metal is to be shaped in a certain way for the purpose of applying it to a typewriter or to a freight car makes really no difference provided the respective pieces are the same, made of the same material, to the same limits and in the same quantities.

It was found that the equipment was good in spots only and that there was so little appreciation of the inadequacy of the equipment as a whole that the single machine or single operation here and there, which might be considered good, was shown off, evidently in the belief that here was something superior to ordinary shop practice whereas, as a matter of fact, it was merely above the level of the average in the railroad shop. One of the most striking discoveries was the number of very old machines. In one of the shops the master mechanic had been with his company and in its shop for 22 years and, in all that time, he had received only one new machine tool. Another thing equally surprising was the inadequacy of the tooling for some of the machines. Old and inadequate as these machines were, they were prevented by poor tooling from accomplishing even as much as they might have done.

> That the practice in railroad shops is materially different from ordinary shop practice is readily understandable, but why is the practice in one railroad shop so widely at variance with that of almost every other railroad shop?
>
> Why is the equipment generally so archaic and inadequate? Why is the tooling so bad? Why are there so many makeshifts in evidence to the most casual observer? Why is individual output so low? Why is the purchasing department permitted to overrule the mechanical department as to the make of machine tool to be bought?
>
> Answer these questions and you know a large part of the reason why the railroads are having such difficulty in getting their bad order rolling stock in shape. It isn't all a question of machinists and labor unions by any means, as will be shown in this article and the ones to follow.
>
> The American Machinist has made a critical survey of the situation and presents its findings in a series of articles that will run for several weeks. They are unsigned because they represent the work and thought of the staff rather than the efforts of any one man.

Still another weakness exposed was the poor selection of equipment in many cases. There was an instance of what might be called a manufacturing department in one of the shops where brass parts were made to be used in the various shops and roundhouses of that line and where not a single brass working lathe was present, all the operations being done by ordinary engine lathes with geared headstocks. Here was a case where money was spent unnecessarily and the result was an equipment entirely unfit for the work.

It looked like the trail of one of the old-style grafting railroad purchasing agents, most of whom, fortunately, have passed out of the limelight. This case differed from the general run of instances of purchasing department inefficiency in that the equipment was more expensive than necessary. In the vast majority of cases, the recommendations of the mechanical department men, who knew what equipment they required to turn out the right kind of work, had been ruthlessly ignored and cheaper tools, hopelessly inadequate but coming somewhere near the specified requirements, had been substituted. The waste and inefficiency resulting from this method of purchasing is impossible to calculate but it must run into many millions.

Time Lost on Machining Operations

Control also was lacking, not the control of the operations in regard to the repair of locomotives but control of the individual machining operations. The idea seemed to prevail that all effort should be concentrated on expediting the repair of the engine, meanwhile forgetting all about expediting the individual jobs in the machine shop. While it is certainly better to gain one day on the engine as a whole than to gain the work of two days on the details, it is true also that, if this work on the details is expedited, there may be a chance to gain two days on the engine.

Still another thing was the utter lack of uniformity in the machine shop operations. There was apparently no system by which the management of the shops of the various railroads could get in contact with each other. We say "apparently," for we could see no results which might naturally be expected to come from such an interchange of ideas. As a matter of fact, the master mechanics do get together in convention and occasionally do visit each other but each one seems to feel that his own way of doing things is best and consequently nothing that might be called standard practice has been developed. A certain pride in tradition may explain the attitude of railroad shop men so far as their feelings toward each other's work is concerned, but no such feeling should exist where methods of other machine shops are under consideration.

Neglecting Lessons Taught by Manufacturing Shops

Unfortunately the chances of railroad mechanical department men visiting manufacturing shops are remote and they are handicapped to the extent that they have not the opportunity for seeing how jobs are handled in such shops. There may be differences in detail in the way manufacturing shops carry out their operations but unless such a shop comes somewhere near the average efficiency of other shops of a similar nature it is bound to die. In railroad shops this does not seem to be the case, and naturally so, because a railroad shop does not need to show profits.

In shops where production must pay for everything that goes on, bad conditions of tools, faulty methods and systems cannot persist very long without causing the financial failure of the company. But the railroad shop is merely a repair shop. The profits are made by locomotives, passenger and freight cars and the repair shop is nothing but an expense. At least that is the way it may impress the heads of the company because the good work the repair shop does cannot appear on the profit and loss statement. Fortunately the late strike has brought out the fact that the repair shop is a very essential part of the railroad system, just as essential as cars or locomotives. Nevertheless it may be that the idea that the shop is merely an expense and not a producing element is responsible for a great deal of the conditions the writers observed and the reluctance to spend money on the shops. That such policy is wrong would probably be conceded by any manufacturer except, perhaps, by a railroad company, which is also a manufacturer though it may not know it.

Misdirected Economy

Even where possibly five minutes were saved by taking exceptionally heavy cuts (and the word "possibly" should be doubly underscored, as will be shown later), as much as 30 minutes were lost because of the lack of handling devices.

Connecting rods are made in automobile shops. There are certain differences in these connecting rods and there are certain differences in the equipment of the various shops which make them. As a result one will find slight differences in the methods of manufacturing connecting rods in automobile plants, but after all there is very little to chose between the various methods as far as economy goes.

Connecting rods are also made in the railroad shops but there is the widest imaginable difference between the methods employed by one shop and those used by another. This difference is not merely one of method but of economy as well. When we see that in one shop the square block which must be removed in order to form the jaw at one end of the connecting rod is laboriously drilled out, in another shop milled out, in still another shop partly sawed and partly slotted and in still another slotted from beginning to end, we naturally ask why there should be such an enormous difference in methods, especially when the difference also means that in one place 5 or 6 times as much time is used for the operation as in another.

Lack of Tools

In one of the shops the question was asked whether the sawing out of the two long sides was ever considered and the answer was that the method was well known but that there was no saw capable of doing it. There was in that shop a milling machine which might have been used for milling out the block by means of the now well-known method of employing a helical milling cutter, but there was no tool suitable for the purpose. In short, the operation was done that way because the means for doing it were at hand and it was the old way of proceeding.

There is another method that few seem to know of, the method of cutting out the rod ends with the torch. Both the cost of equipment and the speed of operation of that method should recommend it for consideration.

In one shop a connecting rod was being surface milled on a planer-type milling machine. According to a statement from the shop authorities the machine was

not sufficiently powerful to do the work economically but it was exceedingly difficult to get the necessary appropriations for a new machine. Whether an attempt was ever made to get the appropriation was not stated but it may be taken for granted that it was. Accepting the fact that the machine was too weak, this was certainly no reason why a cutter much larger in diameter than necessary was used so that the number of revolutions per minute was lower than it might have been. This, in the case of a milling machine, means reduced production. Nor was there any reason why the cutter should be without rake or with so little chip space that even a light cut would have stalled the machine. The machine was first noticed about 11 a.m. when it was well under way and had milled a considerable portion of the connecting rod. At 3 p.m. it was still well under way but by no means near the end. There is, of course, some satisfaction in seeing an old friend again in the afternoon after one has made up his mind that he will have passed beyond recall in the forenoon. But whether this joy should be experienced with connecting rods seems doubtful.

An Analysis of One Job

Here, then, is a complicated condition. Machine too weak (though there were no visible indications of it). cutter too large and not properly shaped or ground, authorities that were not willing to furnish the proper machine or possibly entirely ignorant of the fact that such a machine was wanted.

Other little items were observed on this job. For instance, the cutter was so much out of round or possibly the arbor was sprung so much that only one-third of the cutter was doing work. With the same machine and the same cutter properly mounted about three times as much work might have been done. If, in addition, the tool had been properly constructed and sharpened, a still further advance might have been made in production. Question: Who is responsible for such conditions and why aren't they corrected?

While we were making some casual remarks about the condition of the cutter, its mounting, etc., the information was volunteered that there were a number of other cutters which might be examined. These cutters were found on a bench behind a post (not in the tool room but in the main shop) covered with dust and in all imaginable conditions of dilapidation. There were perhaps 10 or 12 cutters of which no two were of the same construction or style. Some had inserted blades, others were solid; some had the blades held in by wedges, others by soft metal cast in; still others by a screw which opened a slot midway between two adjacent blades. Nothing seemed to be known as to which construction was the best or why the various constructions were used. Some cutters had rake, others hadn't. Some were merely dull, others had large chunks broken out of the blades. Briefly it was a sickly looking job lot of expensive tools.

Reasons Without Logic

One of the reasons given to explain the absence of the best methods of machining is that after all the locomotive repair shop should first, last and all the time concern itself with the task of repairing the locomotive in the shortest possible period of time and that it is of much more importance to have the locomotive out of the shop and on the road again a day sooner than that several days be saved in various machining operations. Even if a little more time, and consequently money, is spent on the milling of the connecting rod it should be kept in mind, so the argument runs, that this connecting rod is not the final aim and so long as the connecting rod is ready to go on the locomotive when required there is very little reason for complaint. If on the other hand the connecting rod were finished in a minimum time but a day was lost in the getting ready of the locomotive there would be very serious reason for complaint.

This argument is uncontradictable except in so far as it offers no excuse for spending more time on the connecting rod than is necessary. If the superintendent, general foreman or master mechanic, whatever his title may be, needs all of his time and energy in seeing to it that locomotive are not delayed in the shop, there is still the possibility of having somebody else attend to the details and it certainly cannot be said that the locomotive would suffer if the connecting rod were made in less time and at less expense.

The Alibi Generally Used

This idea that everything must be subject to the main aim of getting the locomotive out of the shop seems to be used as a general alibi for all the detail work which is either done wrong or uneconomically. The example of the connecting rod was taken here because it is so easy to visualize the various machine operations which must be done on this piece. The idea of using a parting tool supported in a long slender bar, fastened to the ram of a slotter for the cutting out of the large chunk of metal at one end of the rod is so much at variance with the best present-day practice that it alone would be enough to justify the questioning of railroad shop methods.

That this same operation is done well and economically in other shops, also railroad machine shops, does not improve matters because it is an indication that there is no such thing as a separate and distinct railroad machine shop practice but rather that every shop seems to have developed its own practice and possibly, even probably, that this practice has not been developed but like Topsy has merely grown up.

Politics and the Personal Equation

Then, too, there is in most cases a lack of personal interest in the economical operation of the shop. In but few instances have the men any forceful personalities to be loyal to. It is easy to be loyal to a strong man whom you know, but difficult to be loyal to a mere name which means nothing to you except as so many letters in the financial columns of the morning paper. Neither can railroad shop managers who are notoriously underpaid inspire an enthusiasm which they do not feel. The uncertainty of continuous employment of the shop officials in the past has also had its effect. Railroad politics, usually beginning in Wall Street, have upset the morale in many a railroad shop. This is particularly true where the roads are financially weak, as it seems to be a habit of railroad management to change the whole personnel with the advent of a new president or receiver.

We have asked the question, "What's wrong with the railroad shops?" It is expected that the answer will be completed with the last article of the series. Before going further let us nail down the faults just disclosed:

Inadequate and inefficient equipment.

Ignorance of those responsible as to what is proper equipment.

Improper tooling.

Lack of control of machining operations.

Disproportionate subordination of machining operations to moving the locomotive from the shop.

Insufficient exchange of knowledge and ideas between railroad shops and manufacturing shops.

Inability of those responsible to see that the railroad shop directly affects profits.

Lack of proper work-handling devices.

Prevalence of conditions causing lack of personal interest on the part of shop men in economical operation of the shop.

(The second article will appear Nov. 16.)

Six Ways of Securing Co-operation and Interest From Your Men

By E. O. Kuendig

Factory Manager, The United Electric Company

(1) Always treat your men as human beings and give them a fair deal.

(2) If there should be any shortages in pay, instruct your paymaster to be courteous to the men when they complain and adjust to their entire satisfaction. Make them see clearly that you have done the right thing by them and, if they are wrong, be sure and convince them accordingly. Do not let them go away until they have seen exactly where they made the mistake. If the company is in the wrong and the shortage amounts to dollars, try and give it to them at once. Do not make them wait another pay before they get it. Of course, if it only amounts to a few cents it will be satisfactory I am sure to any workman to let it go until the next pay. I cannot dwell upon this point too strongly, because I have seen so many workman go away from a paymaster's office disgusted on account of not being given courteous treatment. In some cases I have heard them say, "Oh! the Hell with it, what is the use of telling the paymaster about the shortage, he is always right."

(3) Put your cards on top of the table and never do anything underhanded. What I mean is: If you have anything to tell a workman, or if you want to time a man to set a piece-work rate, come right out with it and don't beat around the bush.

One day a foreman came to me and said: "Mr. Kuendig, I would like to have the rate setter time John Doe. I want his job on piece-work, but I'm afraid John is one of those men that will loaf on the job if the rate setter should go up to his bench and tell him we are going to time him. Don't you think the best way would be to have the rate setter stand back of another machine and time him so John wouldn't know anything about it?" I was rather surprised at the foreman and told him so and also gave him to understand that we weren't doing business that way and told him that we would time John and let him know just what we were doing—explain our purpose, show him the stop watch and explain to him how to read it and try to get him interested before we started. It was amazing to see the attitude John took after we were through. In fact, he is now one of the best men to time and always works at his regular speed when we are setting a rate on the job on which he is working.

(4) Check over your payroll each week and make sure each employee is earning a living wage. In other words, see that his pay envelope contains enough money so that he can live and not just exist.

Instead of trying to get co-operation from your employees by spending money on advertising literature, etc., to tack on the shop bulletin boards, put the money in the employee's envelopes and they will be with you forty strong.

(5) Do not try to kill a man by expecting him to overwork himself so that when he gets home he has no "pep" left. Make your motto "A Fair Day's Work, at a Living Wage," so that when he goes home after work, he can work in his garden, if he has one, or take the children out for a walk. By doing this you gain the good will of his wife and family and your employees will like to come to work instead of doing it grudgingly. There is nothing worse than to have your employees come to work because they have to. If you can get them to come because they want to you have won your point and will get the fullest co-operation on all problems.

(6) Always speak to your employees when making your rounds through the factory in the morning. Don't wait for them to speak first, but make it your duty to beat them to the greeting. Never let them get the idea that you think you are better than they are.

In closing I wish to say that if the methods outlined above are carried out, you can rest assured that your employees will be with you at all times and help you to solve your troubles whenever you call on them.

Cutting Down Production

By A. W. Brown

This action of cutting down production, with its corresponding reduction of the working force, is sometimes inevitable, but usually undesirable, not merely that it drives up the overhead percentage, but because it also involves the probability, when full time is resumed, of having to break in new workers to fill the places of those laid-off employees who have found work elsewhere. There is also the distress likely to be caused to the workers and their families.

In general, the humane manufacturer lays off those who have no dependents; and as between any two having none, giving the preference in regard to staying to older men who might find it more difficult to change place of residence or of occupation than younger ones would.

This method of choice does not always make for efficiency in the end, but humanity also has its claims. There are, however, cases where even men having dependents should be laid off among the first. I refer to those who have proved themselves either inimical to the management, or unadaptable to the work and methods in vogue.

Whether to shut down one department altogether, or to lessen production in all, is not always optional with the management. It is important, however, that those who would get the best results from any production organization keep in mind the expensive process of any labor turnover as well as the moral effect of constant changes on their employees.

Some Printing Press Shop Methods

A Crank-pin Drilling Fixture—Pneumatic Presses for Taking Off and Replacing Crank Disks—A Crank Planer Job and a Crankshaft Straightener

BY FRED H. COLVIN
Editor, *American Machinist*

THE driving mechanism of the Chandler and Price printing press has a substantial shaft with a disk at each end. These disks carry crankpins which must be in line with each other. One of the disks, the larger of the two, has a cam groove cut on the inside and is a press fit on the shaft. The other is smaller and is a snug push fit.

The disks are located by keys and, after being assembled on the shaft, the crankpin hole is bored and reamed in the smaller one in the fixture shown in Fig. 1. The shaft is held in temporary bearings, the disks located by a suitable index and the drill guided by a bushing in a bracket at the end of the fixture. This fixture is mounted on an old New Haven lathe which has been fitted up especially for this purpose. The crankpin hole is drilled and then reamed to size, quick-change holders enabling the tools to be handled rapidly. The hole in the large disk is drilled in a previous operation, a suitable pin in the hole already drilled locating the position of the hole in the other disk.

The next step is to remove the small disk to allow for assembling in the press frame. The disk is pulled off by the special pneumatic puller shown in Fig. 2. The puller is suspended from a chain hoist and guided by the arms *A* and *B* on the rods at each side. Air pressure is controlled by the three-way cock *C*. This view shows the crankpin hole in the large disk at *D* as it rests on the floor block. Another air press forces the small disk in place on the shaft in the final assembly, as shown in Fig. 3. The large disk has had gear teeth cut in the meantime as shown at the right. The forcing press is portable so as to be easily handled by the chain hoist. It is swung over the printing press so that the ram on one end, and the stop in the cross-bar on the other are centered with the shaft. Then air pressure forces the disk in place and it is on to stay. After this, the rest of the assembling goes on to completion, although little more remains to be done.

A Crank Planer Job

The planing of the bed of this press is done on the crank planer, as shown in Fig. 4. The bed has a swinging motion, the fulcrum being at the end of the legs. The casting is located and so lined up that the sides of the bed, which form the roller tracks, will be square with the holes for the shaft in the ends of the legs. The ends of the legs are squared up by means of the gage *A* and the portion of the bed being planed to receive the chase is squared with the bosses through which holes are afterwards bored, by means of the bar *B*. The width of the bed between the raised tracks for the rollers is gaged by the measuring rod *C*. This is rather an unusual job and the crank planer has been found very well adapted to it.

Crankshafts will spring at times and in order to straighten them easily and quickly the pneumatic press

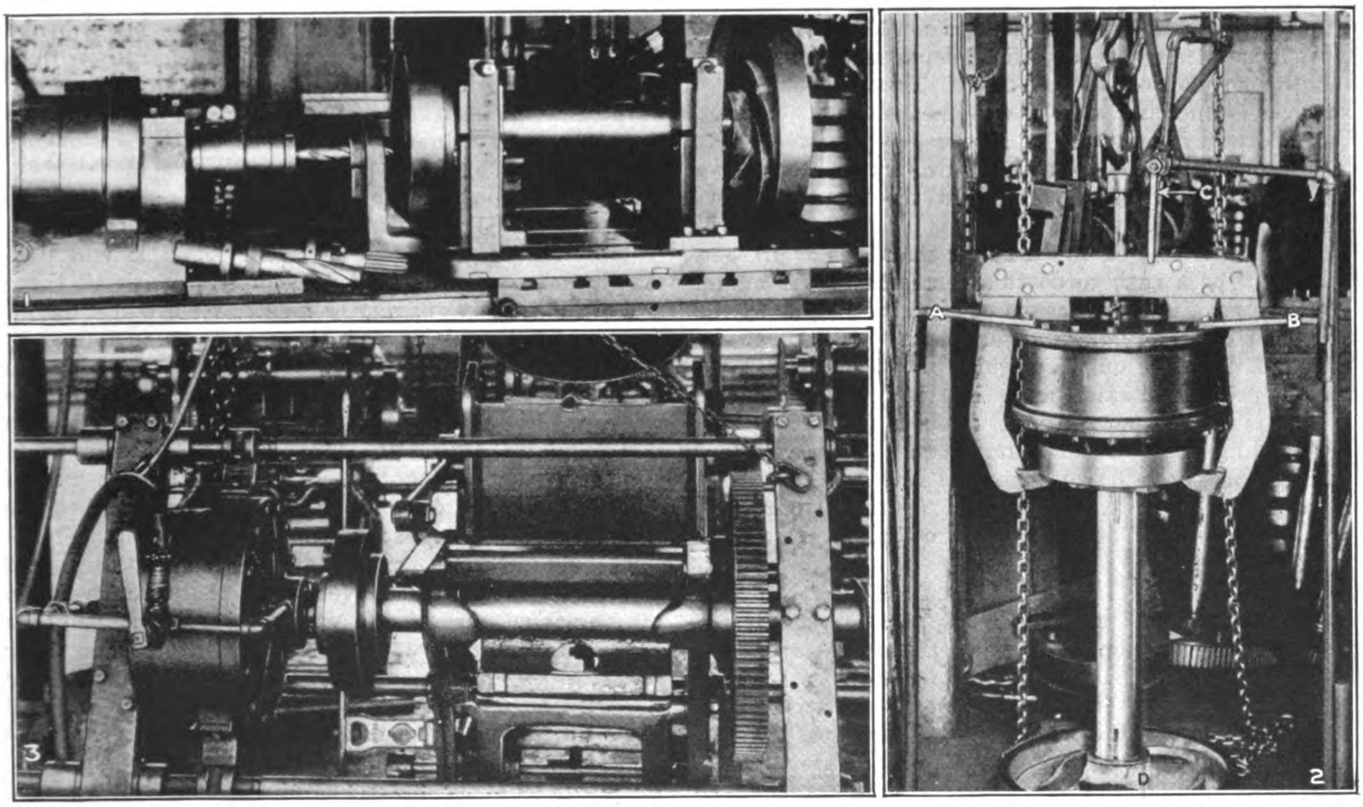
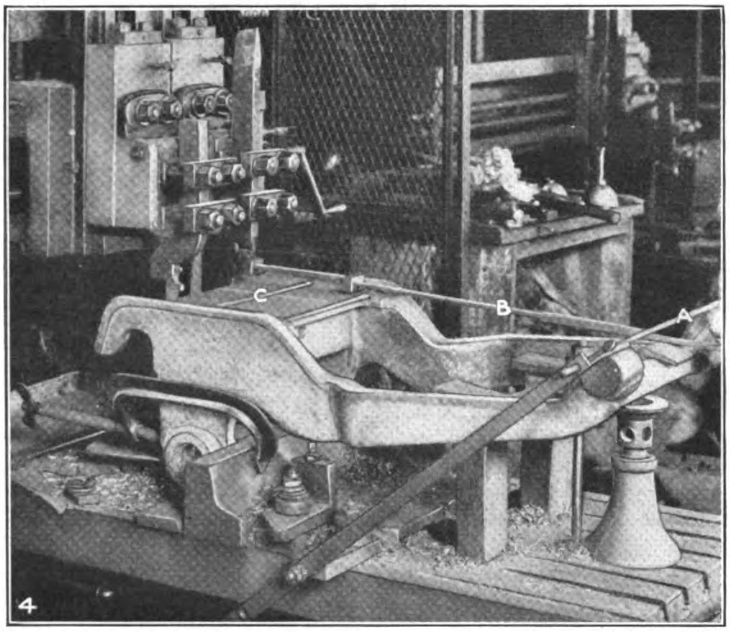


FIG. 1—DRILLING CRANK PIN HOLES. FIG. 2—REMOVING CRANK PIN DISK. FIG. 3—ASSEMBLING THE GEAR SHAFT



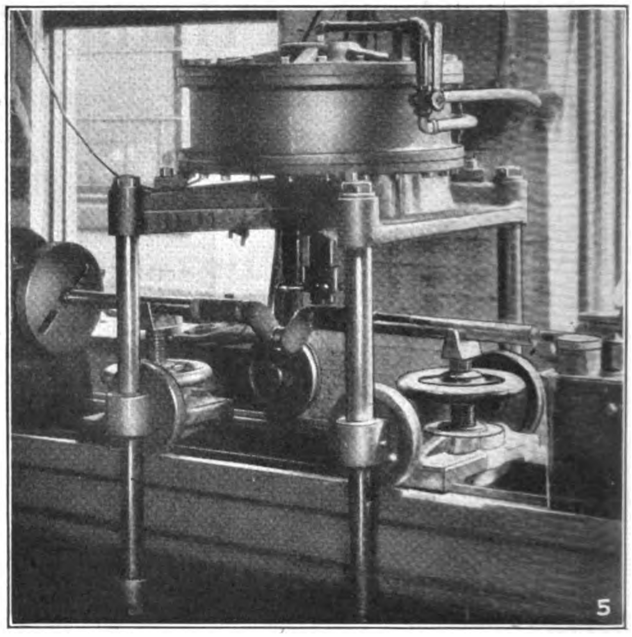


FIG. 4—PLANING THE BED. FIG. 5—AN AIR STRAIGHTENING PRESS

shown in Fig. 5 has been built especially for this work. Here again an old New Haven lathe forms the bed for the operation. The press is mounted on four wheels which fit the outer ways on the lathe and enable it to be easily moved to any position. Cross-bars under the bed, together with the four rods, take the thrust. The shaft is mounted between centers but the stress of the bending is taken by the two adjustable supports, *A* and *B*, which can be easily moved to any position on the bed by sliding them on the inner ways. This arrangement makes a very convenient straightening press and the method can be easily adapted to other work.

Coming Management Methods

By Entropy

When we were beginning to furnish munitions for the World War we found ourselves in such keen competition for all kinds of skilled and unskilled labor that most firms of any size organized departments primarily for the acquisition of workmen. These departments, however, soon found that it was cheaper to try to keep the labor they had than to secure new workmen only to lose them to some equally enterprising representative of another shop. From this grew the art of employment management, so-called.

When business gets much better than it is at present, there will be a rush to do this same thing over again. We have not the ready means of recruiting labor by the ship-load from foreign lands as we had previous to the war and therefore only a slight demand for labor over that at present in existence is inevitably going to place it at a premium and continue the constant accusations of "stealing" help and the same keen and unscrupulous enticing of workers from one field into another. This usually results in transferring a floating labor body from one center of departure to another, never stabilizing it anywhere.

Are employers going to see the futility of this lack of management and are they going to adopt means for training the local population to do their work and treat it well enough so that the desire to roam does not prevail? If they do it will be because the idea is sold to men higher up in the organization than most employment managers have been. It will be because superintendents, general managers and presidents see the necessity and direct that their shops be run in accordance with that idea.

It becomes simply a matter of dollars and cents. How far will a thousand dollars go when invested in wages? Will it go further if invested in improved working conditions? Will it go further in an athletic field? How about shorter hours or longer hours and overtime pay? Is good foremanship a good investment? Does it cost more, or less, to lead men rather than drive them? All these questions and many more will have to be answered by someone who has his finger on the pulse of the finances as well as on the sentiments and ambitions of his workmen.

This is a job for the business management. It is inseparably tied up with cost accounting, planning and distribution of work, with efficiency, and it will ultimately have to be handled in connection with all these and other branches of management. We are dealing, on the one hand, with dependable figures, as to tonnages, power costs, and handling of materials, all of which can be established with fair certainty that they will be where we left them when we shut down last night. On this hand we deal with human beings whose temper and temperament, hopes, fears, and health, both mental and physical vary from moment to moment and require the services of the most expert of psychologists.

These psychologists will have to include boards of directors and managers even more than employees in the personnel offices. We will have experts in human engineering just as we have experts in mechanical, or electrical engineering, men who will advise, not the employment manager, but the general manager. All these things suggest a new era in management, a time when boards of directors will consider gravely the questions which during the last days of hectic business were left to chance or to untrained men in the employment office.

Industrial Standards in Germany

Work of Establishing Standards Is Under Direction of Central Committee—Has Been in Progress for Four and One-Half Years—International Co-operation Desired

BY H. O. HERZOG

STANDARDIZATION in Germany dates back to the second half of the last century. It had existed, as in other countries, to a certain degree before that time but was restricted to a limited number of articles. Its applications were few and far between and were, in the main, the result of custom, which in the course of time has caused some standards to be more or less generally adopted as a matter of expediency. Such cases were the standardization of structural steel, sheets and wire, which originated in 1873 and has since been in constant progress. Standardization of pipes followed in 1882, restricted to cast iron pipes, while in the case of wrought-iron pipes the English standards prevailed. The latter were followed in many cases, the foremost of which is the British Whitworth screw thread.

The greatest progress was made in the standardization of railroad material, where conditions were most favorable; the railroad management being centralized in a few hands. Although energetic pioneer work was not lacking and foreign progress acted as a spur, standardization by deliberate and systematic action was slow and strictly tentative. Germany has always been peculiarly reluctant to take the initiative in such matters. This attitude must be ascribed to the strongly pronounced leaning toward an international treatment of the problem. Purely national standardization was and is still considered an incomplete solution. German engineers have been eager to co-operate with other nations, but were averse to proceeding alone. The most striking instance of this attitude is probably the establishment of the metric screw thread, of which Germany was the originator.

For such reasons standardization as a prominent problem of industry has remained considerably behind the developments in the United States and England. No pressing need was felt for its furtherance, and the reluctance to take independent action checked individual efforts. A strong impulse has evidently been lacking. This impulse was supplied by the exigencies of the war which, as in other countries, taught the country a sharp lesson in the matter of quantity production. Imperative necessity has overcome the latent resistance; furthered by the fact that international procedure had become a mere remote possibility. The long deferred problem of standardization was then seriously taken in hand.

The initiative was taken by the War Office Department of Arms and Ammunition, which entrusted its execution to the Society of German Engineers. Under the leadership of the latter a standardization committee was formed for the machine-building industry, in which a number of other associations, like the Society of German Machine Tool Builders, of Tool Makers, the Association of Wood Working Manufacturers, Steam Engine Manufacturers and others, were represented. This committee commenced operations in direct and most intimate relation with the government offices, and was primarily subservient to the needs of the war industry. The first step taken was to make a survey of the standards which had grown up in various works and get the latter into contact, with a view to bringing about an interchange of experiences. The first actual work taken in hand was the standardization of cylindrical and taper pins, drills, keys, and temperatures. This Standardization Committee soon spread out into an organization comprising the whole industry, which was formed in December, 1917, under the name of Standardization Committee of the German Industry.

> THE standardization work of Germany is keeping strictly within the scope of standardizing parts and units, measurements and dimensions. The Committee is averse to venturing upon the field of standardizing aggregates. No pressure is exercised upon any industry for adopting the new standards, but it is hoped that in the course of time this adoption will gradually proceed of its own accord. Summing up the present situation, it can be said that the industry as a whole is receptive and the necessity for thorough standardization is recognized as a principle everywhere. It is felt, however, that the progress is somewhat slow, and that an energetic propaganda is needed for speeding it up.

The organization has since then been considerably enlarged, and reflects now in its elaborateness the inherent thoroughness of the German. It is composed of a head committee whose function is to supervise and direct the work along broad lines, while the actual work is carried out by managing committees which are formed, one for each specific task, and of which there now exist a large number. The head committee comprises representatives of government offices, like the Post Office, the Navy, National Economic Ministry, Ministry for Public Works, Ministry of Finances, War Ministry, the Patent Office, the Physical and Technical Institute, the Polytechnic High Schools, the National Testing Laboratories, and those of a great number of manufacturing associations.

All groups of industry in which standardization work is carried on are represented. It is presided over by a board consisting of prominent men of the industry, of the railroad administration, and several government officials. It maintains a permanent office, where the chief function is to remain in constant contact with a large body of advisers recruited from producers, consumers, government offices and scientists.

The proceedings are conducted in the following way: After deciding upon the standardization of a certain article, on the initiative of the committee or on suggestions from outside, connection is established with the groups already mentioned—producers, consumers, officials and scientists—with a view of procuring material to work upon and to arrive at a definite primary understanding. Then the work is passed on to a managing

committee elected for this purpose. The principle underlying the procedure is to systematize the information received, so far as is practicable, special care being taken to insert new standards if the demand for such exists. The opinion of the industry on proposed standards is invited in the fullest possible way.

After being completed it is, by publication in a journal, submitted to public criticism for a specific period. After this period has expired, the comments received are scrutinized, and thereafter it is the chief task of the managing committee to find a suitable compromise between the conflicting criticisms and counter-suggestions submitted. The result is then passed on to a consulting committee consisting of a number of prominent men of industry and technical scientists. The members of this consulting committee are carefully chosen to exclude any possibility of private interests playing a part in its deliberations. The approval of the committee finally decides upon the proposed standardizations.

Committee Active

A great deal of work has been completed during the four and a half years of the committee's existence. It comprises nearly all parts of industry; machine building being predominant. The starting point of the new organization was to lay down fundamental diameters, a matter concerning the industry as a whole. As the decimal system made it impossible to adopt pure arithmetical progression, considerable difficulty was encountered at first. It was found necessary to circularize a large number of manufacturers in order to find out the most customary diameters and those little used. Upon the replies received a system has been built up, which, adhering to arithmetical progression as far as possible, avoids decimals by rounding out figures according to prevalent customs. A preference for certain diameters and aversion to others could easily be observed and this was the means of guiding this work towards a basis for the ultimate determination of standard diameters.

Amongst the work for machine building completed may be mentioned the following:

Mathematical formulas, sizes and execution of drawings, temperatures, figures, diameters, tapers, radii, screw threads, fits, bores, shafts.

Standards of machine-building material: copper, brass, bronze, cast iron, steel castings, drawn and rolled steel.

Hardness tests, Brinnell method.

Keyways, drill jigs, drills, counterbores, thread-cutting tools, grinding disks, cutting tools, measuring tools.

Long List Completed

Handles, spigots, handwheels, keys, chains, ball bearings, cranks, bushings, rivets, pipes of mild steel, lubrication rings, bolts, nuts, spanners, washers, stuffing boxes, gears.

The standardization committee is often confronted with an overwhelming number of existing sizes. Following a line of compromise, the elimination achieved is not radical but constitutes a decided progress. This may be seen from the following instances giving the number of standard sizes which existed prior to standardization and those remaining after:

	Sizes Before	Sizes After
Keys of less than 100 m/m width	298	44
Transmission shafts of 30 to 200 m/m diameter	28	17
Clamp and flange coupling	124	14
Hanger bearings	146	46
Pedestal bearings	33	14

The standardization of threads has this year been concluded. Inquiries of numerous firms have disclosed the remarkable fact that the Standard International metric thread has made comparatively little progress and has not been able to replace the Whitworth thread, not to speak of numerous other thread systems used.

Original Idea Abandoned

The original intention to make the adoption of the S.I. metric thread general has been abandoned in view of the strong leaning of the industry towards the Whitworth thread, and efforts have been concentrated towards eliminating the other threads in use. At the present stage of standardization two recognized threads for machine building remain, the metric thread with an angle of 60 deg. and the Whitworth thread with an angle of 55 degrees. Of the great number of special threads only a few have been retained, like the saw-tooth and buttress thread and the round thread (wire thread).

The following data show the economy achieved by the now concluded standardization of threads:

	Before	After
Thread systems	10	2
Kinds of threads	274	72
Tools:		
Thread gages	548	144
Taps	822	226
Dies	548	144

The S.I. metric thread in diameters of from 1 to 150 m/m. and the Whitworth thread from ¼ in. to 6 in. are now completely standardized. The Whitworth thread coincides with the standards of the British Engineering Standards Committee. Another large task was the standardization of forged and machined screw bolts. Starting with heads round, square and hexagon, points and nomenclature, the standardization of bolts is now almost completed and has brought about a considerable reduction of existing sizes.

Further Progress

As an indication of further progress, recently made, may be added the standardization of pipes by bringing the existing standards into harmony and establishing standards for high, medium and low pressure. Formerly the flanges and their screws were different for the various pressures, while after the standardization their dimensions are adjusted according to the size of the pipe, independent of the pressure.

In several lines of industry, as in motor-car manufacturing, and the electrical industry, standardizing work is carried on by independent committees formed by the respective manufacturing associations; but even in such cases where the work is decentralized provision is made for connection with the head committee in order to eliminate interference. The desire, already mentioned, of German engineers for co-operation with other nations, chiefly England and America, in the matter of standardization has never been quite effaced, and has, with the restoration of peace, almost regained its former force. The viewpoint that isolated standardization in the various countries stands in the way of an international treatment of the subject has, however, been abandoned and the theory adopted that the former has to precede the latter in order to create a basis for it.

This thought was strongly emphasized in a conversation your correspondent had with Mr. Hellmich of the Society of German Engineers, in whose hands the permanent work of the organization rests, and who wishes it to be pronounced emphatically that German

engineers have no intention whatsoever to establish German standards with a view to use them as a weapon in international competition. They strongly hope that the parallel work going on in the various industrial nations will ultimately lead to concerted action based upon the existing national standards. The German Standardization Committee is glad to perceive that this idea is finding full understanding with similar organizations; proof of which is the connections that have already been established. Such connections, of an official nature, exist already between the German Standardization Committee and most others; as the American Engineering Standards Committee, the Canadian Engineering Standards Association, the Austrian Standards Association, the British Engineering Standards Association, the Standards committees in Holland, Italy, Sweden and Switzerland.

In a few instances where such is not yet the case, personal relations have been taken up. An exchange of approved standards is taking place between existing standardization committees. The standardization sheets, which are in themselves strictly standardized and made up alike with the sole difference of language, make comparison easy. As a first step towards closer co-operation, this exchange is said to have been entirely successful. Any further steps in this direction will be heartily welcomed by the German Standardization Committee.

The standardization work of Germany is keeping strictly within the scope of standardizing parts and units, measurements and dimensions. The committee is averse to venturing upon the field of standardizing aggregates. The reception of their work by the industries is said to be satisfactory although it can be seen that in cases where tradition is strong the introduction of new standards meets with considerable resistance. Such resistance must be contended with, however, as it could not be expected that manufacturers will go to the expense of adjusting themselves at once to new standards. No pressure is exercised upon any industry for adopting the new standards but it is hoped that in the course of time this adoption will gradually proceed of its own accord. Summing up the present situation, it can be said that the industry as a whole is receptive and the necessity for thorough standardization is recognized as a principle everywhere. It is felt, however, that the progress is somewhat slow, and that an energetic propaganda is needed for speeding it up.

Automatic Electric Temperature-Regulating System for Furnaces

By I. William Chubb

Editor European Edition, *American Machinist*

The firm of Adolphe Saurer, Arbon, Switzerland, which build commercial vehicles for practically all the countries of Europe, have in their heat-treatment department a system which automatically controls the temperature of the furnaces by varying the position of the dampers. Coke is used as fuel and the same system will obviously apply to coal-heated furnaces. Where gas, oil or electricity are employed, however, a somewhat different scheme will be necessary. The appliance can be set so that the desired temperature, once obtained, can be maintained for any length of time with an accuracy ± 1 per cent at low temperatures and $\pm .75$ per cent for high temperatures.

Fuel Consumption Minimized

The system controls six furnaces working equally well whether the temperatures in these furnaces are the same or differ, and the firm state that the heat remains so steady without special attendance that the recorders trace horizontal lines. The fuel consumption being proportionate to the average temperature, is minimized and the furnaces can be worked with a smaller number of attendants, but the chief merit of the temperature-regulating device is that as far as it goes it guarantees the correct heat-treatment and thus ensures the high quality of materials required in the finished product.

In Fig. 1 is illustrated the exterior of the mechanical part, the heat being varied by controlling the draught in the chimney with a slide, which is itself controlled by the electric regulating device to be described. This view shows a horizontal shaft, which carries a double-arm lever, with one end connected by a rod to the chimney damper. To compensate for the weight of the rod and fittings, a counterweight is carried on the other arm and the housing contains two magnets the function of which is to rotate the shaft enough to raise or lower the regulating damper.

The control system is illustrated in Fig. 2. From the thermo-electric pyrometers placed in the furnaces, current is taken to an ordinary galvanometer *A*, the switch device *B* enabling any one of the six thermocouples of the six furnaces to be connected up so that the galvanometer will indicate the temperatures of the furnace put in circuit. At *C* is a similar galvanometer except that, instead of the temperature scale, it has two parallel arc-shaped troughs filled with mercury and concentric with the axis of the needle of the instrument. Both troughs are contained in a block of vulcanite, one trough being divided at the middle into two portions by a mica partition. The glass pointer of this galvanometer is provided at the free end with a U-shaped platinum wire, connecting when necessary one trough with the other. Normally the U piece does not dip into the mercury, above the surface of which the needle plays freely.

By means of a switch *D* the pyrometer of any furnace

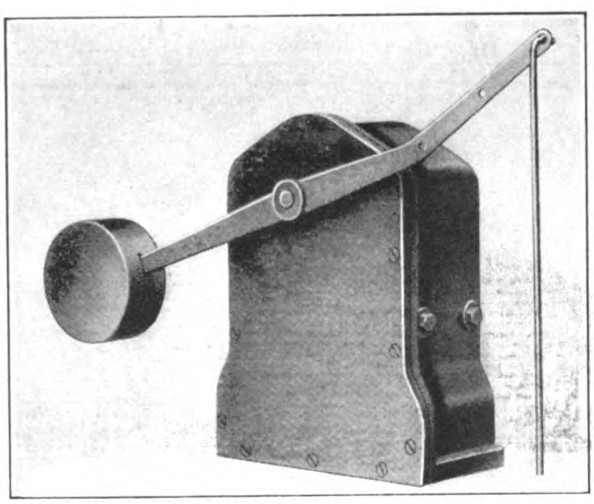


FIG. 1—DAMPER ACTUATING ROD AND MAGNET HOUSING

can be connected to the contact galvanometer *C*, the needle of which will travel to a certain point depending on the temperature. At intervals the wire hoop visible at *E* is caused momentarily to press the galvanometer indicator downwards, the platinum wire then dipping into the mercury if the temperature is incorrect. By this means a circuit is closed which, according as the temperature is too high or too low, that is, according as the pointer dips into the mercury trough to the right or left, will permit a heavy current to pass, to excite the electro-magnets in the housing (see Fig. 1) and cause the damper to close or open.

The switch *D* is operated by the motor *F* so that the six furnaces are connected up in turn. The motor also serves to press the hoop *E* downwards, the power required for the motor being in the order of 0.02 hp. It is arranged that there is no voltage on the circuit when the platinum hoop dips into or emerges from the mercury and consequently, as the platinum contact is not subjected to wear or dirt due to sparks, its life is practically unlimited. The speed of the motor and the gear ratio have been chosen so that the regulation of all six furnaces requires about 3 min. The temperature of each furnace is therefore controlled every 3 min. and when, by the limits mentioned, it is higher or lower than is required the damper can be adjusted.

If the furnace temperature is correct, the needle of the galvanometer seats itself directly over the mica partition, preventing contact between the two mercury troughs. While the position of this partition is determined by the construction of the galvanometer, adjustment of any desired temperature is made possible by inserting in the pyrometer circuit of each furnace a suitable resistance so that the galvanometer needle is over the mica partition at the required temperature, whatever it may be. Fig. 3 illustrates the size resistances of the lower part of the apparatus. In front of each is a scale for temperatures from 170 deg. to 1,090 deg. C. Each scale carries a device for adjusting the resistance, together with a pointer which indicates the temperature.

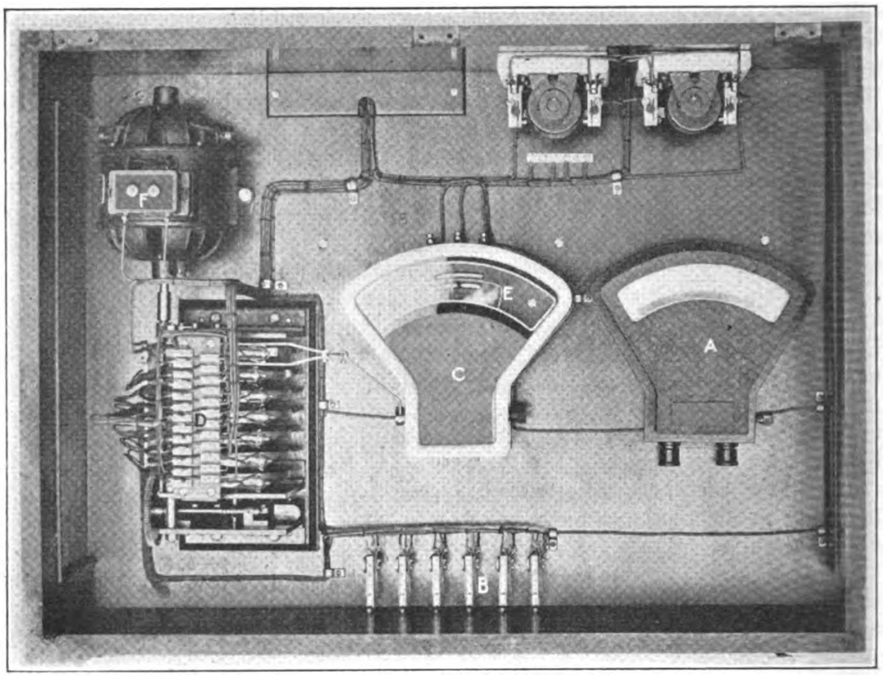


FIG. 2—GALVANOMETER CONTROL PANEL

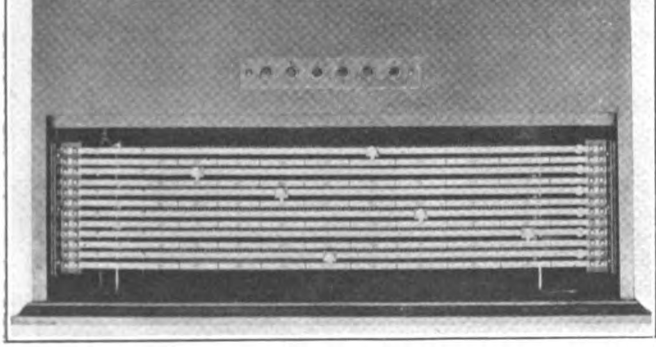


FIG. 3—GALVANOMETER CIRCUIT RESISTANCE UNITS

Cutting Oils vs. "Soap Water"

By H. B. Egg

In an endeavor to learn what is the best practice in using cutting lubricants, the writer visited a number of high class shops, hoping to profit by their example. I returned with lots of information, but little satisfaction. Below are tabulated the results of my investigation, omitting names:

	Our Shop	1st Shop	2nd Shop	3rd Shop
Milling machines	Water	Oil	Water	Water
Gear cutters	....	Water	Water	Oil
Hand turret lathes	Water	Oil	Water	Water
Automatic screw machines	....	Oil	Oil	Oil
Drills	Water	Water	Water	Water
Cold saws	Oil	Oil	Water	Water
Threading lathes	Water	Oil	Oil	Oil
Thread millers	....	Oil	Water	Oil
Hack saws	Water	Water	Water	Water
Broaches	Oil	Oil	Water	Water
Engine lathes	Dry	Oil	Water	Dry
Boring mills	Dry	....	Water	Dry
Grinders, (Production)	Water	Water	Water	Water
Grinders, (Drill)	Dry	Water	Dry	Water
Grinders, (Cutter)	Dry	Water	Dry	Dry

Under the name of "water" are included all of the various emulsions and compounds using water. The different kinds of oils used was amazing, ranging from lard oil to *near* lard oil mixed with varying proportions of paraffin oil. One shop kept down the cost of its oil by mixing with it a big percentage of kerosene.

Our rule had been to use water where much heat was developed and where the sizes were not held to close limits, or anywhere else if we felt like it. We used oil on forming operations and on tools which we wanted to keep sharp a long time. For tapping, we used machine oil or any old thing handy, and the other shops visited did not have anything on us in that respect.

It appears to us that shops buy cutting lubricants or coolants from the most convincing salesman and continue to use his brand until a more persuasive talker pays a call. There should be a more scientific method of selection.

Methods of Machine Tool Design

Further Continuation of the Subject of Cam Feeds for Machine Tools—Beginning of the Analysis of a Screw Machine Drum Cam

By A. L. De Leeuw
Consulting Editor, *American Machinist*

The timing of cams aims at a construction by which all the cams used will co-operate without interference and without loss of time. Merely avoiding interference would be easy by allowing a sufficient amount of time between the successive operations of various cams to make sure that the functioning of one has completely ceased before the work of another one begins. In doing so, however, one would sacrifice a certain amount of time which might well be saved by a careful analysis. Such an analysis should be undertaken every time a new job is put on a given machine. The designer of a special machine, arranged for one operation only, has practically the same task before him as the man who arranges an existing machine for a new job. When a standard machine must be designed, the problem is somewhat more complicated. Even with a special machine the timing of cams is somewhat more complicated than the arranging of a standard machine for a new job.

Some of the operations performed by an automatic machine require a variable amount of time, while other operations always require the same period. Instances of the first kind are the turning, or boring, or reaming on an automatic screw machine. Instances of the second kind are the stock feed, indexing, and shifting of belts. Conditions are still further complicated by the fact that, though the indexing might always take place at the same speed, the machine may be so arranged that the index speed cannot be kept constant. As a rule, such operations as indexing are carried out on the high speed (if there is one). In some machines this high speed is constant, in others it is variable. As illustration of the various possibilities, we cite the following examples:

Fixed Ratio Between High and Low Cam Speeds

In the original Spencer machine there was a fixed ratio between high and low speed of the cams. This ratio was established through the differential gearing in the feed pulley. With a given machine this ratio could not be changed. If it was desirable to reduce the feed, or rather, lengthen the cycle, for a certain piece of work, the feed pulley was run at a lower speed so that all operations were carried out at a slower rate. Indexing, stock feed, shifting of belts, all was done slower, not because it was desirable to do so but because it was necessary to have a slower cutting feed or perhaps because a piece was longer or of harder material.

At other times it might be desirable to shorten the time for a complete cycle and this was done, of course, by giving a higher speed to the feed pulley. Here we would run up against another difficulty. It was not possible to reduce the cycle below a certain point, because increasing the feed had also increased the speed of indexing and it would be imposible to index at too rapid a rate. As a result, it was often necessary to take more time for a complete cycle than was actually needed for the cutting operations, simply because some of the idle operations could not be carried out with the proper speed of the feed pulley.

In machines like the Cleveland machine, the high speed is constant, whereas the various feeds are adjustable entirely independent of the high speed. High speed and feeding movements, however, are tied together in one cam and there is no possibility that any of the cams can get out of time with any of the others. On the type of machine represented by the Brown & Sharpe screw machine we find a different set of conditions. It would be possible here to arrange this machine so that one operation might interfere with another, for instance, by wrongly setting the dogs, or by the failure of one of the idle operation cams to act at the proper time. In this machine the cam which gives the forward and backward motion to the slides and turret runs at a constant slow speed, that is, its speed is constant during the job, though it may be changed for the next job. The movements of the cams for idle movements run at a speed which is always the same regardless of the speed of the main cam.

Problem of the Automatic Screw Machine

For the reason that there are so many different combinations possible, it is exceedingly difficult to indicate a system by which cams can always be timed properly, unless we reduce the movements of the various cams to one common unit. This unit is the revolution of the work spindle in the automatic screw machine. In some other machine it might be a stroke or a reciprocating tool. In still other machines it might be some other function again.

Confining ourselves for the present to the automatic screw machine we would say that it requires so many turns of the spindle to complete the first cutting movement, so many for the second, so many for the third, etc. We would determine the high speed by the maximum speed we would dare to give to the parts operated upon; for instance, the speed of indexing. From this high speed we would calculate the number of seconds required for each of the idle movements as well as for the different returns, and we would then reduce that number of seconds to revolutions of the work spindle, so that we would obtain the total number of revolutions of this spindle for one complete cycle. We will illustrate this by a concrete example and assume that the following conditions exist:

The machine has a constant high speed for cams.
The various feeds are made by the different slopes given to the cam.
The cams can be given various speeds for the feed movement by change gears.
All cams are geared together.
The work revolves at 300 r.p.m.
First operation requires stroke of 1 in., feed of 0.010 in.
Second operation requires turret feed of 1 in., drilling feed of 0.006 in., and feed of cross slide for forming of 0.0025 in.

For the author's forthcoming book.

Depth of forming is ⅜ in.

Third operation requires length of stroke of ¼ in., feed of 0.005 in.

Fourth operation requires a length of stroke of 1 in., feed of 0.015 in. and a cross feed for cutting off of ½ in., feed of 0.002 in.

Fig. 170 is a diagram in which all these various movements are laid out, each one for itself and without regarding any of the other movements which may take place at the same time. The lower bar takes care of the turret motion, the second bar takes care of the cross-slide movement, the third one of the index, the fourth of the opening and closing of the chuck, the fifth of the stock feed.

Duration of Cutting Operation

As the first cut is 1 in. long and the feed is 0.010 in. per revolution, 100 revolutions will be required for this cut. In a similar manner we figure that the second, third and fourth cut taken by the turret tools will require 166⅔, 50 and 66⅔ revolutions respectively. We also find in a similar way that 150 revolutions are required for the feed of the forming tool and 250 revolutions for the cut-off tool.

In regard to the index, we will assume that it was found that one second is required to complete the various operations necessary for one indexing. These operations include the withdrawal of the locking pin, the moving of the turret, and the replacing of the locking pin. As one second of time corresponds to five revolutions of the spindle, and as we have assumed four stations of the turret, four times five revolutions of the spindle will be required for all of the indexing

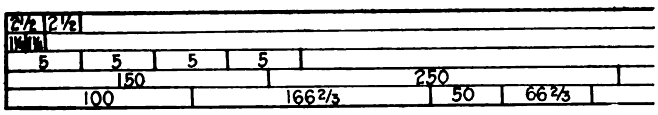


FIG. 170. DIAGRAM OF SCREW MACHINE OPERATIONS

movements. We will further assume that ¼ of a second was found practical for the opening and closing of the chuck and that ½ second is required for the stock feed and another ½ second for the return of the feed shell. This will give us 2 × 1¼ revolutions for the opening and closing of the chuck and 2 × 2½ revolutions for the stock feed. In this manner we have obtained the chart of Fig. 170. Though we have taken care of all of the elements which our operation requires, we have neglected to consider the time which may have been spent on account of the peculiarities of the cam.

Our machine is a special one and we can assume any slope of the cam which we may deem desirable. We will assume a slope of one to three for the feed and forty-five degrees for the return. We will further assume that the cam roller is 1½ in. in diameter. Laying out Fig. 171, in which *AB* is the cam slope for feeding and *BC* that for return, and placing the roller at the points *A* and *B*, we notice that the distance traveled by the roller along a horizontal line is more than the base of the triangle of which the height is 1 in. This little distance A_2A_3 must be added to the time required for the feed of 1 in.

We will now lay out Fig. 172 which shows all of the feed and return strokes side by side. This diagram shows us something which was overlooked, namely, that the slopes cannot be the same, except when the feed per revolution of the spindle is the same. We see that operations *2* and *3* have a gentler slope than operation *1*, but that operation *4* has a much steeper slope. This operation *4* happens to be a reaming operation in our case, so that a steep slope is permissible. However, in some other case we might have been compelled to make the slope of operation *4* more gentle, say one in three,

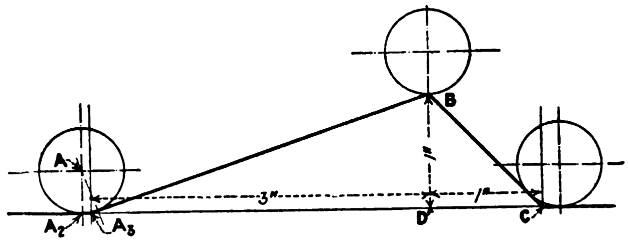


FIG. 171. CAM LAYOUT FOR FEED AND RETURN

and in that case the slopes of the other three operations would have been gentler than shown in this diagram.

It also brings before us at once something else which we have so far neglected, namely, the advance of the tools. It may well be that the tools are set in such a manner that only a very short advance is required, but as a rule this is not the case and for our illustration we will assume that the final position of the turret at the end of the feed stroke is always the same regardless of what was the amount of the feed. We will further assume that, for the sake of safety, we have

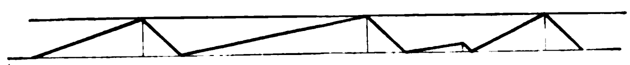


FIG. 172. DIAGRAM OF FEED AND RETURN STROKES SIDE BY SIDE

allowed one extra inch of advance in all cases; so that we would have for operation *1* one inch advance, one inch feed, and 2 in. return; for operation *2* the same; for operation *3*, 1¾ in. advance, ¼ in. feed, and 2 in. return, whereas the fourth operation will be the same again as the first two. This makes our diagram as shown in Fig. 173.

It would be possible to calculate the extra distances which we have to allow due to the curvature at the point where two parts of the cam join but this would involve a large amount of calculation and we will find it to be easier to determine these amounts graphically. With this in view we have laid out Fig. 174. In this diagram the length of the cam is the distance from *A* to *B*, which we find by measurement to be 30½ in.

Without going further with this cam, we now start the consideration of the cross-slide cams. Looking at our schedule of the various operations performed by the machine, we find that the forming takes place at the same time that the second turret tool operates. This turret tool requires 166⅔ revolutions of the spindle, whereas the forming tool requires only 150 revolutions. Thus, if we can start both operations at the same time, we will find the cross-slide ready to return before the turret tool is in that condition. This will give us a

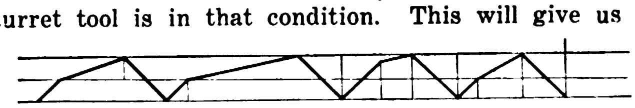


FIG. 173. DIAGRAM WITH ALLOWANCES FOR EXTRA ADVANCE

chance either to start the cross-slide tool somewhat later, to finish with it somewhat earlier, to give a dwell to the cross-slide tool at the end of its forming operation, or to have a combination of these things.

When we look at the second cross-slide operation, we find that it corresponds to the fourth turret tool operation. This fourth turret tool requires only 66⅔ revolu-

tions for its completion, whereas the cutoff tool requires 250 revolutions. Before deciding how to arrange the relation between these two, we must consider what these operations mean. It stands to reason that the reaming operation must be finished before the cutoff operation is completed. It also stands to reason that the reaming tool must be completely out of the hole before the finished piece drops off, so that the fourth operation not only must be finished but the turret must have returned before the cut-off is completed.

other action at *C*, we might have interfered with the return of the cross-slide. At *D* we notice the same thing we have noticed at *A*, namely, that we are still on the advance of the cross-slide when the feed of the turret has started. This means that we have to shift the upper diagram to the left. When we make a shift sufficient to start feed of cross-slide and turret at the same time, we will find that the entire operation of the turret, its feed and return, are completely finished when we are still on the feed of the cross-slide. In other

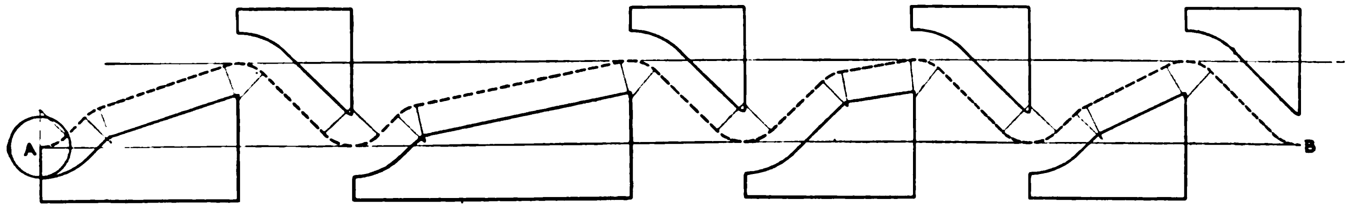


FIG. 174. GRAPHICAL DETERMINATION OF CURVATURES

Looking at Fig. 174, we see at a glance that the total distance required for feed and return on the fourth operation is less than the distance required for the feed only of the second operation and, as this latter feed corresponded to $166\frac{2}{3}$ revolutions of the spindle, realize that the entire reaming operation with its return can be accomplished in less than $166\frac{2}{3}$ revolutions and, therefore, will be completed within the time required for the cut-off.

words, we see that the return of the turret takes place on the low speed and that even then there is time to spare. It will therefore be possible to make the return line for the turret at a more favorable angle than 45 deg., and that without loss of time.

We have estimated the time required for the remaining operations in seconds and reduced them to revolutions of the spindle, that is to say, we figured one second for the index and said that this is one-sixtieth of 300, or five revolutions. When we said that the first turret operation required 100 revolutions we could determine how much of the circumference of the cam would be required for this operation because the slope of the cam was known. The return, also, was easily determined because the amount of cam required for this function depended entirely on the amount of return and the slope of the return cam. When it came to determining the amount of space to be allowed on the cam for the period of indexing, we had no such data and we attacked this problem from a different angle.

Control of the Cross-Slide Tool

We now construct Fig. 175, which shows the center-line of the roller movement of Fig. 174, and immediately above a similar center-line for the roller movement of the cross-slide tool. We will imagine that these latter tools are controlled by a cam just like the one we are constructing. As a rule this latter assumption is not correct and we are making it here merely to simplify our first analysis. We notice that the feed begins in the lower diagram at the line *AA*, but that we are still at the advance in the upper diagram. To correct this we can do one of two things: We can either place the upper diagram further to the left—in other words, start the advance of the cross-slide tool a little earlier—or else place the lower diagram somewhat to the right—in other words, start the feed for the turret somewhat later. This instance shows how necessary it is to combine the diagrams for the various cams, because, merely looking at our original schedule, it would have seemed that we would have a surplus of time for the forming operation.

Nevertheless, it is well to look at things before making a picture of them. Though our conclusions were faulty, the thoughts which led up to them were necessary, because without them we would not have constructed Fig. 175 for a check and we would not have found the true condition of affairs. We see at the line *BB* that we are still on the feed of the cross-slide after we have started the return of the turret, which means either that a part of the return of the turret would be on the slow motion or else that we must make the shift mentioned before. At the line *CC* we notice that we are still on the return for the cross-slide when we are on the dwell of the turret. If we had started some

Cam Space for Indexing

To make the problem we have before use somewhat clearer, let us imagine that the diameter of the complete cam drum is 10 ft., which is, of course, a very much exaggerated figure. Let us further imagine that this cam drum makes 60 r.p.m. when it runs at its high speed. Then its circumferential speed is prac-

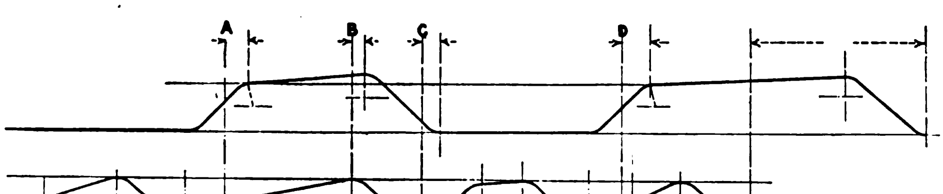


FIG. 175. COMBINED DIAGRAMS FOR TURRET AND CROSS-SLIDE

tically 30 ft. per second. We have found from Fig. 174 that a length of about 2 in. of the cam drum is required for the return of the turret. As 2 in. is $\frac{1}{180}$ part of 30 ft. (the circumference of the drum) it would take only $\frac{1}{180}$ part of a second to return the turret. This shows clearly that we are not free to assume any diameter or any speed of the cam drum. We will therefore select some figures which are more nearly practical,

though we cannot be certain that we shall be able later on to apply these same figures to the problem before us.

Let us suppose that the cam drum is 18 in. in diameter and that the fast speed will permit the drum to revolve once in 6 seconds. We would then have a circumference of practically 54 in. and a circumferential speed of 9 in. per second. The return of the turret would then be accomplished in a little less than one-quarter of a second. Even this seems to be too high for a machine of a size such as the one before us. In order not to do any further guessing, we must determine a safe speed for the return of the turret and we will assume this to be ½ second. We will, therefore, have a circumferential speed of practically 4 in. per second. It should be noted that this return speed of the turret depends largely on the size and construction of the machine and attention should be given to the following rule:

It is better to select a return speed which is slightly too low than one which is slightly too high.

The effect of too high a return speed is excessive wear, danger of breakage, and tendency to loosen machine parts and spoil work. By reducing the estimated return speed from ½ second to ⅓, which is a speeding up of 50 per cent, we increase the momentum of the moving parts 125 per cent and we gain in time four times the difference between ½ and ⅓ of a second. Considering that the total time for our job is practically a minute and a half, a saving of ⅔ of a second is such a small percentage of the total that it is not wise to take any risks to accomplish this small saving. When the total time for the complete cycle is very small, in other words, when the idle times form a large percentage of the total time, then it would be good policy to try to save every little part of the return and other idle movements.

Determining the Size of the Cam Drum

Having determined that the circumferential speed of the cam is 4 in. per second, we find now that we must allow an idle space on the cam of 4 in. for each index (because the index requires one second), 1 in. for the opening of the chuck, 1 in. for the closing, and 2 in. for the stock feed and also for the return of the feed shell. Thus the total length of the cam will be $30\frac{1}{2} + 4 \times 4 + 2 \times 1\frac{1}{4} + 2 \times 2\frac{1}{2}$ plus as much as may be required for the shifting of the two cam grooves of Fig. 175 and minus such parts of the cam as we may find can safely overlap each other. To determine this amount we lay out the diagram 176. In the space between the outer two concentric circles we place the length of cam required for the turret motion. In the next band, spaces required for the cross-slide motion; in the third, for indexing; in the fourth, for the open- and closing of the chuck; and in the fifth, for the stock feed; and we measure all of our distances on the outer circles.

In reality it makes very little difference what diameters we select for the outer circle, the cam drum, but if we select a very small diameter, say 6 in., the length required for the various spaces would make it necessary to go several times around the circle and, of course, this would be confusing. As we found in our preliminary considerations that an 18-in. drum is not very far from the correct size, we will select a size sufficiently greater than 18 in. to make sure that we do not have to go around more than once. The diagram of Fig. 176 is based on a diameter of 24 in.

We start the diagram at A and lay off a length AB required for the advance of the turret, and we do this by reducing the linear advance to the number of degrees required for such a length on a 24-in. circle. We then lay off BC which is the length required for the feed, and CD for the return of the first turret tool. Our schedule shows that the index follows, and we lay this

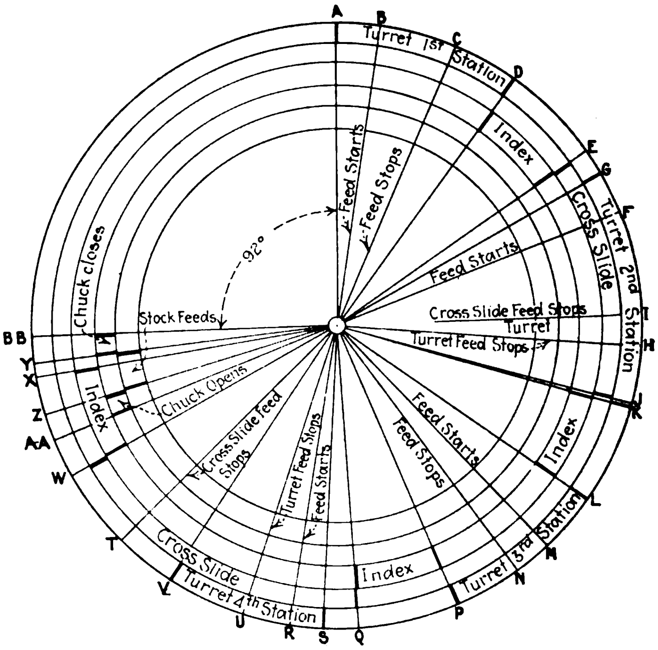


FIG. 176. CIRCULAR DIAGRAM OF TURRET AND CROSS SLIDE OPERATIONS

amount off on the outer circle, again reducing to degrees, but indicating the function on the third band. DE is the space required for this operation.

On the second turret operation, which, as we have seen, is combined with the forming operation of the cross slide, we will arrange matters in such a way that both tools start *feeding* at the same time. We have already seen that we would lose time unless we did so. As the advance of the cross-slide is greater than that for the turret tool, we lay off the distance EF for this advance and then we go back the distance FG for the advance of the turret tool. At the line OF, then, the feed starts for both tools. The length of time of feed for the turret tool is greater than that for the cross slide. FH represents this amount of time, whereas FI is the length of cam required for the cross feed. On the other hand, the return for the cross feed is longer than that for the turret and we lay out IJ, return for the cross feed, first; and HK, return for the turret, next.

Saving Time on the Indexing

Here we should call attention to the fact that it may very well be possible to start the index before the return of the cross slide is completed and it would be necessary to investigate this for every machine or every job for which we lay out the camming. If the swinging turret tools, while indexing, do not interfere with the retreating cross-slide tool, we can save some time or space, or both, on the cam by starting the index before the cross-feed tool has completely returned. As we are often cramped for space on a cam drum, such investigation should always be carefully made. In our case, which is imaginary, we have no data to make such an investigation and we will therefore start the index at

K. This index occupies the space from K to L. We go again through the regular performance of laying out the advance LM, the feed MN, and the return NP, after which we index once more from P to Q.

On the fourth turret position we have again the condition that the advance for the cross slide is greater than that for the turret, and once more we will arrange matters so that both tools start *feeding* at the same time. And so we lay out the distance QR for the advance of the cross slide, and then work back to S, at which point the advance begins for the turret. The feed for the cross slide takes place from R to T, whereas the feed for the turret ends at U. It would be possible to make the return of both tools stop at the same time, but this would mean that the return of the turret tool would be quite slow. Ordinarily this would be an advantage but as, in our case, this tool is a reamer, it is advisable to return it as quickly as possible; and so the movement of the turret would be completed at V, while the movement of the cross slide will end at W. Once more the index takes place from W to X.

Element of Time

Before laying off a new distance for a new function we should make it a point to see whether this new function can take place at the same time as the previous one. In this case there is no reason why the chuck could not open while the index takes place. Even the stock feed can take place at the same time, but as it might be possible that we want to stop the feed either against a turret tool or against a separate stop provided for that purpose, we will arrange matters so that the stock feed is completed some little time after the turret has indexed. We therefore select the point Y, slightly beyond X, for the end of the stock feed, turn back a distance YZ, and then a distance ZAA for the opening of the chuck.

Fig. 176 shows a distance YBB for the closing of the chuck which, of course, must take place after the stock has been fed out. It does not show a distance for the return of the feed shell and this is not necessary because this return can take place at any time during one of the other operations. We find, then, that 92 deg. of our circle are unoccupied, so that, if we want our diagram to conform to the cam drum, we must select a smaller diameter. This diameter would be $\frac{360 - 92}{360} \times 24 = 18$ in. approximately. This final diagram should be laid out because it will be the record for the cam construction and will give all the information later if changes in set-up are required. It is not shown here because it is not necessary for our purpose.

Other Facts Made Evident by Fig. 176

This diagram also tells us certain things to which we have not paid attention so far. It shows that the cam should run at high speed from A to B, slow from B to C, fast from C to F, slow from F to H, fast from H to M, slow from M to N, fast from N to R, slow from R to T, and fast again from T to BB. As A would occupy the same place as BB in the complete circle, we combine the first and last fast movement which then will be from T to B. If we make our diagram on paper in which the circle is divided into 360 deg. and if the disk on which we set the dogs for slow movement is also divided into degrees, we can make a fairly accurate initial setting of the dogs without any trial.

By doing some experimental work we can determine exactly the point at which the shifts from fast to slow and slow to fast take place for each dog and make a mark on that dog so that, when this mark is set on, let us say, line 85 of the dog disk, the trip from fast to slow or vice versa will actually take place at this point 85. This does not relieve us of the necessity of watching the dog carefully to see whether the trip takes place exactly at the point where we expected it, but it does do away with a great deal of guesswork and expedites the setting up of a job materially.

Reasons for Using Circular Diagram

It might seem that it would be just as easy, and perhaps somewhat easier, to lay out the final diagram on a set of parallel lines such as Fig. 170, and that the total length of such a diagram would then represent the circumference of the drum which we must use. This is true and the only reasons why the writer prefers the circular diagram are, in the first place, that it gives a better picture when the diagram is completed, and in the second place, that it is a somewhat safer method. It is often the case that some of the operations are accomplished not by a drum cam but by a disk cam or some other contrivance.

Such a mechanism must be laid out by itself and the result of such an investigation will naturally be the knowledge that it takes so many degrees of that other kind of cam for the operation. This number of degrees remains, then, the same whatever may be the diameter of our main cam. Let us say that in the schedule we examined we found that the indexing is done by a special cam which requires 30 deg. of the main cam for its completed function. We would have made every sector for the index a 30 deg. angle. If we had found that only 270 deg. of the total cam are occupied, we would then have reasoned as follows in order to obtain the actual size of cam required:

Clearance

We would have said that there are four indexes each of 30 deg. or 120 deg. altogether, which will leave 240 deg. for the other operations. In diagram 176 the index occupied a length of 4 in. or an angle of 19 deg., so that all the other operations occupied $268 - 76 = 192$ deg. This number 192 would have been the same whatever space were required for the index, so that, if the individual indexings required 30 deg. each, there would have been a total of $120 + 192 = 312$ deg. occupied in our diagram and 48 deg. would have been blank. The size of the drum would have been then $\frac{192}{240} \times 24 = 19.2$ in. Laying the diagram out with parallel straight lines would not have shown this relation and would easily lead to mistakes.

In order not to introduce more elements than are absolutely necessary, clearance was omitted in diagram 176. As a matter of fact there should be a small amount of clearance whenever we change from one function to another, for instance, between return of turret and index. This clearance may be in the form of an additional amount of return stroke and even if we should start the index a moment before this stroke is completed there would still be no danger of interference. It may also be done by starting the index a short distance after the completion of the return stroke.

The diagram also shows us that the fast speed of the cam must be such that a distance of 4 in for the index will be traveled in one second, from which the number of revolutions of the cam can be calculated. It further shows us that the distance *BC*, for instance, is traveled during the time the spindle makes 100 revolutions, or one-third of a minute. As we know the angle between the lines *CO* and *BO* we can calculate the number of turns per minute the cam should make on the slow speed end, if the slow speed of this is determined by change gears, we can set up at once for the proper speed. Before going further with some of the problems we will meet in laying out cams it will be well to look at the second element of a cam feed, namely, the roller.

Vacations With Pay

By E. A. Terrell

The following shows how we handle the vacation problem at our works: We have laid out a program of fifty working weeks of six days each per year. The remaining two weeks are devoted to vacations. One of these we arrange to include Christmas and the other to include the Fourth of July. At the present time we do not give vacations at any other periods of the year.

The details of the operation of the plan are simple. Each man in our shop works twenty minutes extra each day, making one hundred and twenty minutes or two hours overtime per week. At the end of the week we pay him for his regular time and place to his credit, in the savings account, the amount due him for overtime. This savings account we consider a reserve for vacation pay. At the end of twenty-five weeks we have placed to his credit, provided he has worked regularly, the total amount due him for fifty working hours. At the time the vacation is given we give him his regular pay envelope and in addition, withdraw from the reserve fund the amount due him for vacation pay.

On our books we charge the payroll account at the end of the week for the amount drawn to pay the current wages. In addition, we also charge the payroll, in a separate entry, with the amount due for vacation pay, crediting the individual accounts of the various workmen with the portion due each. A check is then drawn from our checking account for the total amount due on vacation pay. This check is deposited in the savings account "Reserve for Vacation Pay." By referring at any time to the individual accounts of the workmen we can tell exactly how much is due each of them, and in the event one of our men leaves us before the vacation period arrives, we can readily determine just what we owe him for his overtime and make an adjustment on a few moments' notice.

In the event that one of our workmen should be absent for a day or so during the week, we place to his account the same amount of vacation pay as though he had been present all week, deducting the time lost from his pay for the current week. This eliminates petty entries in connection with the system. We work exactly the same system in connection with the office and sales forces, everybody taking a vacation at the same time. We find that the plan works exceedingly well, requires no complicated accounting, and enables us to know just exactly how much time we will lose during the course of a year.

Drafting Room Efficiency—Discussion

By H. S. Kartsher

In his article entitled "Drafting Room Efficiency," published on page 302 of *American Machinist*, Mr. Sorentrue described a system for recording the results of checking which keeps the drawing comparatively free from defacement by the checker. There seems to be a diabolical craving on the part of the average checker to send the drawing back to the draftsman full of battle scars, presumably because the checker feels that the more errors he points out the better he is filling his job.

From the standpoint of the draftsman, however, the effect of such criticism is very discouraging. After he has taken pains to produce a neat, clean cut drawing, he experiences a certain feeling of personal injury when a strange pencil is used on his work, whether it is at the hands of the checker or because the "big boss" offers some "suggestions." Somewhat similar is the sensation when a new shine is stepped on in the street car, hardly a matter big enough to mention and yet the resentment is induced.

But to return to checking, there are two distinctly different methods used by large firms where there is a considerable amount of checking to be done. Both methods permit the checker to vent his feelings with the colored crayon, to scatter notes or criticisms around at will, and at the same time to keep the original drawing in exactly the same condition as when it left the draftsman's board. The first method is employed by firms who check after tracing. A rough, light blue print is made and two colored pencils are used, a yellow pencil for the check marks and a red pencil for the errors or points that require changing. The red crayon stands out and calls immediate attention to the offensive points.

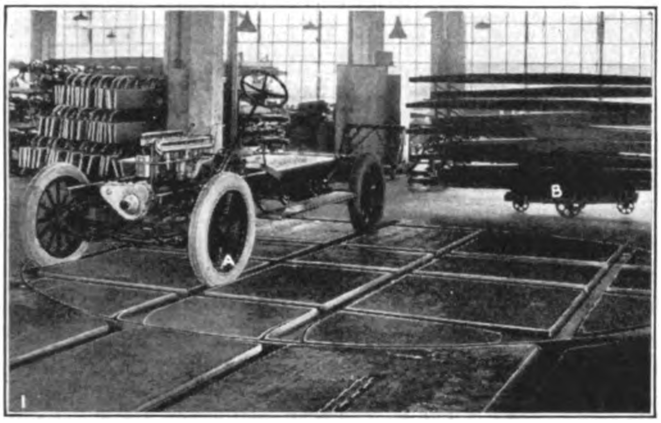
The second method is used by firms who check before tracing. The original drawing is tacked down on the checker's board and a piece of cheap tracing paper tacked over it. Two center lines fix the relative location and checking proceeds as usual. When the draftsman tacks the papers on his board for correction he leaves the two lower corners loose and, after locating the error, throws the tracing paper back and makes the correction. It will be seen that these two methods have all the advantages previously stated. The only disadvantage is the slight cost of the extra paper, which is negligible when compared with the time, labor and feelings saved.

Developing the Worker

By R. Grimshaw

It is a poor non-commissioned army officer who cannot or does not make a soldier out of the greenest "rookie," and who, given men who have served one year, cannot turn them out better soldiers after another year's supervision, instruction and inspection. So with the "non-com" in the industrial army, Sergeant Foreman; he should develop his workers systematically and constantly, so that each month finds them more willing, more interested in the work, and more efficient.

That is why he was made foreman. That is why he was made foreman in the first place. The day when the ideal foreman was an autocratic bully has long since passed. The man for the job now is the thinker in the shop.



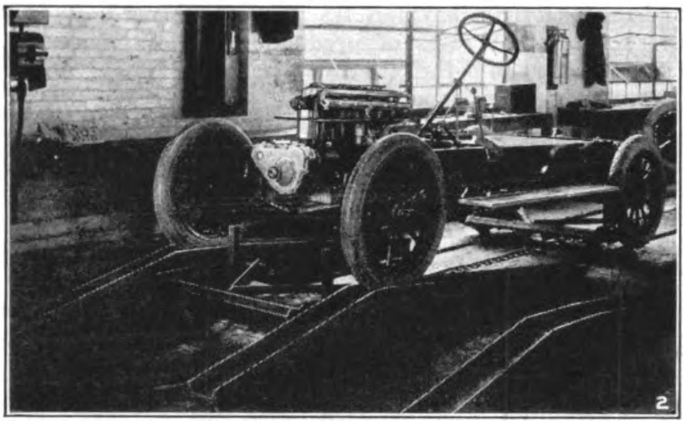


FIG. 1—INCLINE FOR RAISING AXLE FROM TRUCK. FIG. 2—DOUBLE TRACK TURNTABLE

Handling Methods in Automobile Assembly

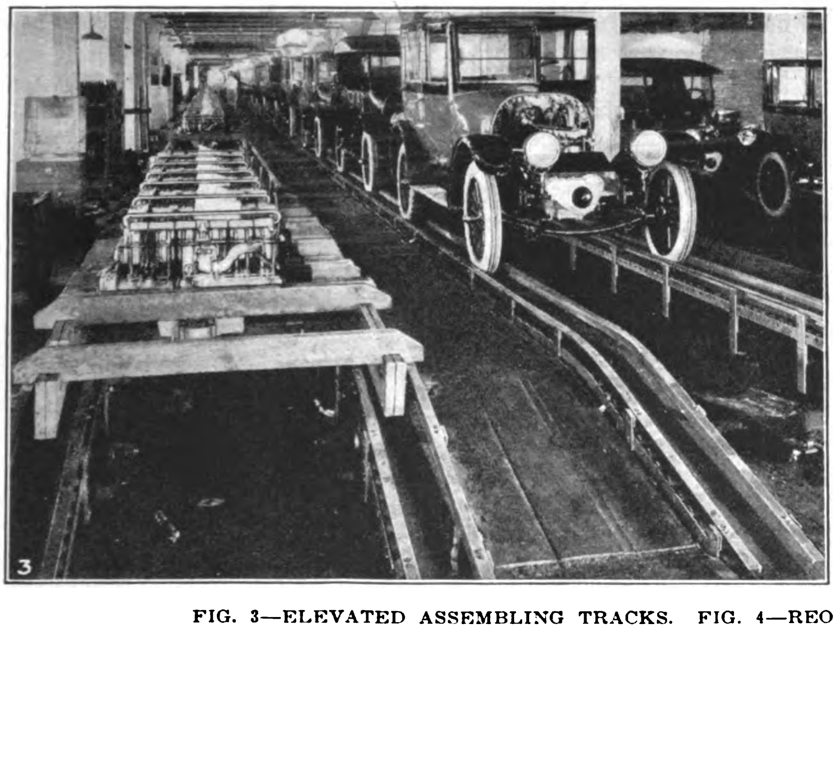
Runways, Inclines and Turntables in the Franklin and Reo Plants—Conveyors and Other Devices Which Reduce Labor and Handling Time

BY FRED H. COLVIN
Editor, *American Machinist*

AS THE different units are assembled and an automobile nears completion, it becomes an increasing problem to handle the work rapidly and economically. The chain belt conveyor has become almost universal in automobile plants and there are many varieties of its application, a few of which, as used by Franklin and Reo, are shown herewith. After the wheels have been put on the axles, the Franklin is carried on small four wheeled trucks at each end, as seen at *A* and *B* in Fig. 1. These trucks are moved along on tracks sunk in the floor, by means of the chain shown between the tracks.

At the end of the runway is an inclined track, raised sides being provided to automatically keep the wheels in line. As the front wheels roll up this incline, the front truck is raised off the truck, and passes freely between the inclined tracks and also off the conveying chain. The rear truck continues to push the chassis until it too, is disengaged by the incline and the chassis is free to go to the next assembly department, while the trucks are returned to the beginning of the assembly line. The incline referred to is at the end of a long building and the next move starts the chassis across the end of the building. A turntable is provided, therefore, as shown in Fig. 2. The interesting feature of this turntable is the two tracks to accommodate both assembly lines at once when required.

Another assembly line is shown in Fig. 3. Here the motors, mounted on their temporary frames, go down the line on the left and are placed in position in their chassis which are on the next track. The motors are shown going down one track and the finished cars coming back on the other. The sequence of operations on these assembly tracks depends upon how many cars



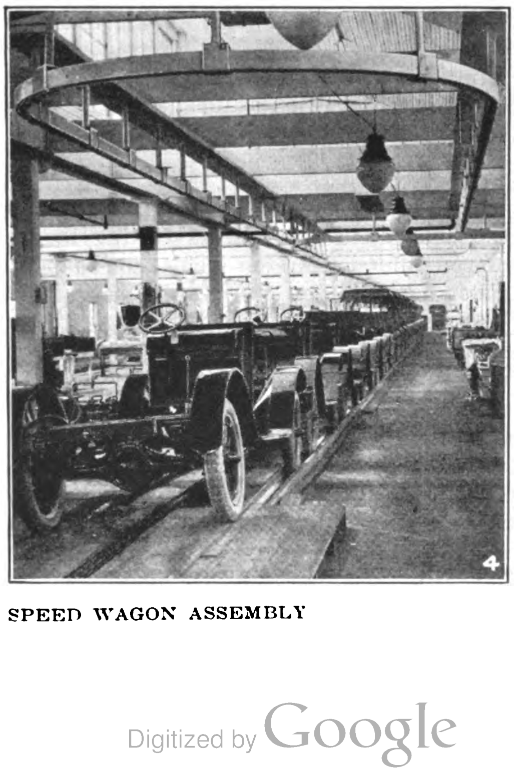


FIG. 3—ELEVATED ASSEMBLING TRACKS. FIG. 4—REO SPEED WAGON ASSEMBLY

are going through the shop per day. The exact routing and the use of the assembly tracks can be readily varied to suit different rates of production. These illustrations were taken before the new Series 10 motors began to go through the shop.

Figs. 4 and 5 are from the Reo plant, the first view showing a line of "speed wagon" chassis going down the assembly track. The conveying chain is very similar to that previously shown but it will be noted that only one rail is grooved, being found sufficient to keep the cars in line. The substantial overhead runway for hoists should also be noted. It enables a motor or other part to be easily handled either in or out of the car whenever necessary. The final end of a similar line of passenger cars is shown in Fig. 5. This view also shows clearly the single grooved rail, as well as the conveyor chain in the center.

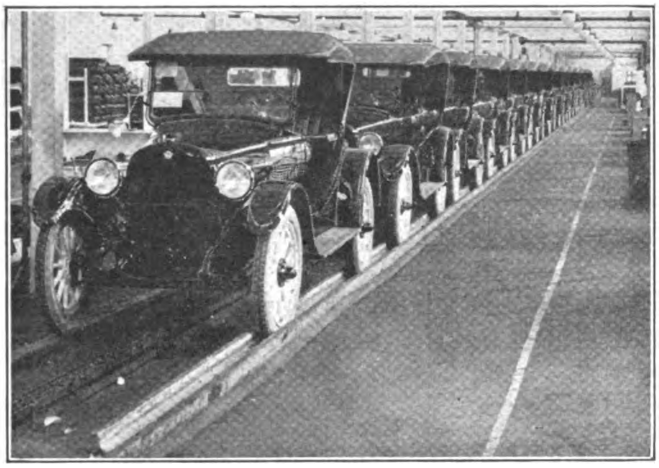


FIG. 5—READY TO LEAVE THE ASSEMBLING DEPARTMENT

A Shop Man's "Just Suppose"

(Written by a shopman after the style of our editorial feature of the same title.)

Just suppose you were a machinist and a member of a machinists' union, just an ordinary fellow, and you were out of work and applied for a job at a large plant where they needed machinists. Before being hired you were asked to sign a paper saying that you did not then belong to any union and that you had no intentions of joining one.

Nonsense, you say. Well, but—

Just suppose.

Or

Just suppose you were working in a shop and during the lunch hour you started talking to another member of your union on union ideals, not radical stuff, and the following day you were fired—with no reason given. You suspected that there was a private detective (?) in the shop employed by the firm to find out who the union men were. Or just suppose that you were this detective with a good job in the shop and about 20 or 30 dollars a week extra for writing just a little report each night on what took place in the shop that day. Don't you think you would be tempted to stuff your reports to make good on your job and continue to get the easy money?

Of course, this could not happen, but—

Just suppose.

Machine Shop Bulls—II

By Joe V. Romig

One day a little old man was brought into the shop by the employment clerk, for an interview with "Reds," our foreman. Reds looked him over thoroughly and started to shake his head negatively.

"Only a chance to make good is all I ask, mister," was his plea and Reds agreed to take him on giving him work on the lay-out plate.

When he started next morning Reds gave him a big sheaf of blueprints and showed him the pile of castings lying on the floor, which he was to lay out for the drill presses. Now it happened that Bill, the regular layer-out, was absent on a week's tear and had locked up all his tools and templets, leaving nothing as a help for his successor.

Reds, to his dismay, also saw the old boy take out of his inside coat pocket his one and only tool, an old three-joint, 2-ft. rule. Turning away he left the old layer-out to his fate, thinking he'd leave him alone long enough to get a stake and then bounce him at noon. Imagine his astonishment when, at 11:30 a.m. old man Williams, the new layer-out, came asking what was next in the work line.

Reds had planned his next move to be his dismissal, but was curious to see just how the old boy had worked him and so went along down to the lay-out plate to see his finished work. Here he found all the work neatly arranged, carefully and accurately laid out and done in less than half the usual time.

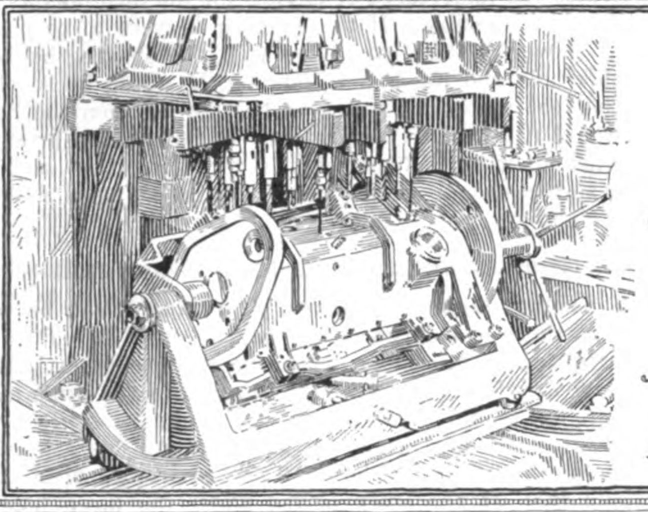
Reds could not help but marvel at the little old boy's work, and breaking away from his usual harsh manner, grabbed the old boy's hand and shook it heartily, saying, "Mr. Williams, I am glad to know you, and I sure am glad to see an old timer like you, make good in a shop so full of these wise looking, know nothing machinists, as I have here. Say," he continued, "they don't make our kind of machinists today, any more, the all-around kind I mean. All we get now-a-days is the damned specialist, etc."

Noticing that his new man had no lunch with him, and suspecting him to be in rather straightened circumstances, he handed him a dollar bill with the suggestion of a little lunch house down the street and a good dinner.

After he had eaten his own lunch he went down to the plate and was shown the improvised tools of the new man, by the admiring workmen who had watched the little old boy pull one over on the Boss. Small pieces of bent and pointed wires were his dividers, nails in Bill's trammel stick were his tram points, a broken tip of an old round file was his center punch, and last, he was shown the surface gage, which was a block, a stick and a nail, complete though simple in its entirety.

Williams worked out the balance of the week, the boys all loaning him tools, which he used at their suggestion and always was sure to thank them for when returning them. When pay day came he shyly asked Reds for all of his money, explaining that he must now be on his way, and thanking Reds for the stake which he had been so kind to give him, and wishing him good luck in the bargain.

Reds regretfully complied with the old boy's request, but they parted as life long friends, these two old-timer, all-around mechanics. And it can be said right here, "They don't make any of our kind any more, only specialists," is pretty nearly the truth.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Progressive Blanking Dies—Laying Out to Avoid Waste of Stock—Bending Dies—Importance of Grain—Relation of Blanking and Bending Dies

WE HAVE discussed plain blanking dies in the previous articles. In this type of die a simple blank is cut out and nothing else done, yet it is often desirable to punch or slot the blank. This last is frequently done by combination of two or more operations in the same die, which is called a progressive blanking die. Such a die differs from a plain blanking die in that a hole or slot is punched out of the stock before the blank is produced, after which the operation of blanking is done in the same manner as previously described. It is called a progressive die because the hole and the slot are made in progressive order. A system of this sort is used for a great variety of work.

In designing a progressive die there are several points which must be carefully considered.

(1) Thickness of stock. This affects the length of the punches used and their spacing. The arrangement should be made so that the blanking punches strike the work before the piercing punches do, in order to relieve the pressure on the machine and make the cutting action easier. A pilot must be arranged on the blanking punch in order to locate the work accurately. The distance between the ends of the blanking and piercing punches should be equal to the thickness of the stock.

(2) Layout of blank. The method of laying out a blank for a progressive die is similar to that used for blanking dies. The space allowed between blanks and around them is governed by the thickness of the metal which is being punched. The arrangement on the strip should be such as to economize and get as many blanks out of a strip of stock as possible. The piercing and blanking punches should be set well apart in order that there will be plenty of metal in the die, so that it will not tend to break away and will be strong enough to resist the pressures applied.

(3) Spacing of punches. When there are a great number of holes close together in a given piece of work this condition often makes it necessary to use several progressive operations in order that the punches shall not be set too close together. It is not generally advisable to have more than three steps in the progression in order that the die may not be too long. It is often possible to build progressive dies in sectional form in order to make the machining operations easier. Also, the up-keep is somewhat better in case of accident or breakage.

In Fig. 467 is shown an example of this type of die for producing the washer shown at *A*. A diagram which illustrates the method of laying out the stock and which shows the order in which the operations are performed is shown at *B*. The hole is first produced at *C*, and after this the blank is cut out at *D* as the stock is fed through the die. The layout of the stock for progressive dies is very similar to those previously described under the head of blanking dies. The distance between blanks, as indicated at *E*, is the relation between the two holes produced. The distance around the blank is equal to the thickness of the stock, and the amount of stock between blanks is in the same proportion.

We have mentioned the importance of the length of punches in relation to the thickness of the blank which is being produced. The punch shown at *F* for producing the hole and the punch *G* used for blanking do not

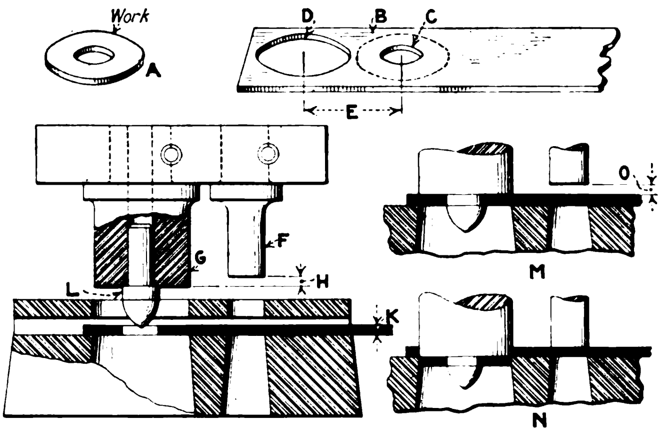


FIG. 467—PRINCIPLES OF PROGRESSIVE DIES

enter the work at the same time but are spaced a distance apart as shown at *H*. This dimension is generally made equal to the thickness of the stock *K* for blanking dies for $\frac{1}{16}$ to $\frac{1}{4}$-in. stock. This gives the blanking punch time to go through the stock before the piercing punch strikes it, thus relieving the amount of pressure re-

quired on the press and also making it easier for the die.

The punch G is fitted with a pilot L which enters the previously punched hole in the stock, thus centering it before it is blanked. This prevents any inaccuracies which might result from an improper method of stopping the stock. The pilot is provided with a round nose

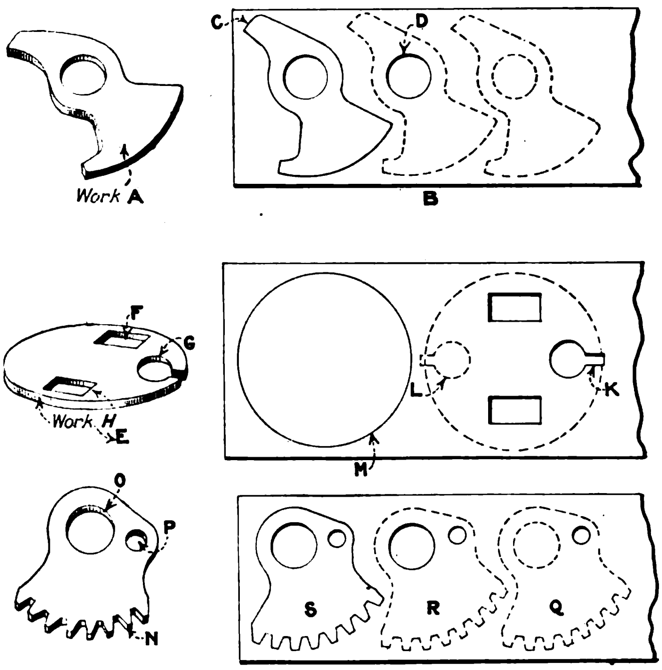


FIG. 468—EXAMPLES OF PROGRESSIVE LAYOUTS

as shown and its action is evident. The hole in the punch G into which the pilot fits extends entirely through the punch. This is done so that the pilot may be knocked out and replaced when necessary. The diagram at M shows the action of this type of die very clearly, the blanking punch having just come down on the stock and the pilot having centered the work by entering the hole previously made. The piercing punch still remains above the stock a distance O equal to the thickness of the stock.

In the diagram at N the action is shown after the blanking punch has produced the blank, which is being carried down through the die. At this time the small piercing punch has just come in contact with the work and its further movement will evidently produce the small hole. It is important in designing a pilot for a blanking punch that there should be a straight section on it equal to the thickness of the stock being punched, in order to insure an accurate location.

Layouts for Progressive Blanking Dies

In order to show the application of the principle to progressive blanking operation, several layouts are illustrated in Fig. 468. The part shown at A is a lock segment, a number of which are required in a certain piece of mechanism. The layout for stock is shown at B. The hole is produced at D, while the blank is punched at C. The layout of the blank is such that the greatest economy of stock can be made.

In the example E a piece of somewhat different shape is shown having various holes and slots at F, G and H as indicated. The hole G, it may be noted, runs out to the edge of the stock, and it is customary in a case of this kind to extend the punch a trifle beyond the blank diameter as shown at K, in order that a clean edge will be made. This is an example which illustrates the importance of having the die openings as far apart as possible. If the opening K were to be placed as shown by the dotted lines at L, the opening between this hole and the blank diameter M would be so close that the amount of stock in the die between the holes would not be heavy enough to withstand the pressure when blanking. This point is very important and the designer should always bear it in mind when making a layout.

Progressive Blanking for a Gear Segment

Another segment is shown at N, and it can be seen that there is a large hole O and a small hole P to be produced in it. These holes are close together, but it is not advisable to locate the punches in the same manner. It would be better to use one more step in the progression and make the two piercing operations as shown at Q and R. The small hole is first punched at Q, and then as the stock is fed along the large hole is pierced at R, after which the finished blank is produced at S. It is occasionally necessary to design a progressive die with as many as four steps in it, although it is advisable to group the punches in such a way that not more than three steps will be required. This point has been mentioned previously.

Among the examples of plain blanking dies several

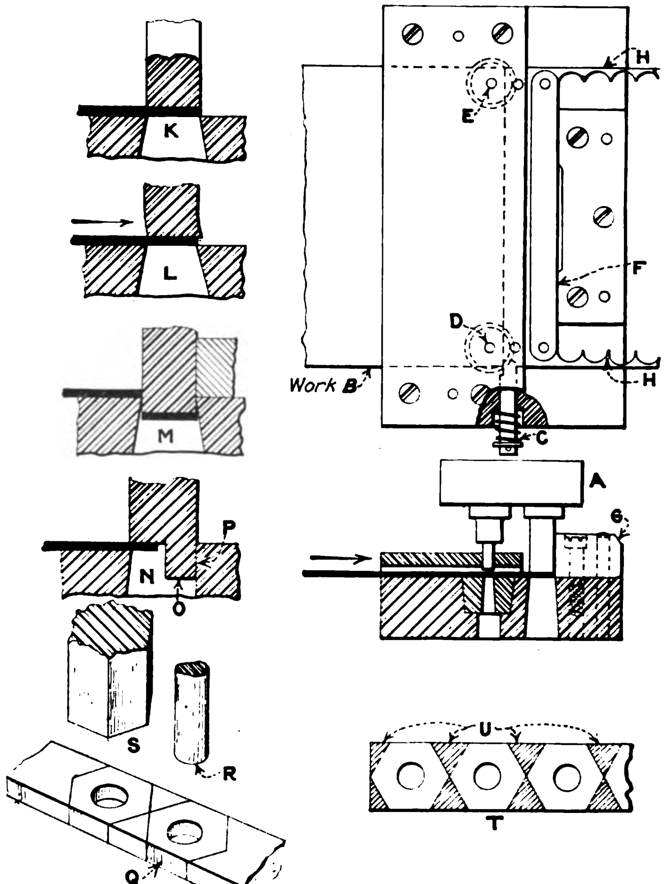


FIG. 469—PRINCIPLES OF DIE DESIGN, SHOWING METHODS USED TO AVOID WASTE OF STOCK

were given in which no allowance of metal between blanks or around the edges was necessary. So also in progressive dies the same conditions are occasionally found. For example, the edge of the stock may be used as the side of the blank, or the blanks themselves may be cut off so that no metal is allowed between the parts. Fig. 469 shows two examples of this kind At

A is shown a progressive blanking die for stamping hacksaw blades. The stock *B* is fed into the die through the stripper as shown. It is pushed forward by hand and located in its starting position by means of a starting finger *C*. This finger is more in the nature of a temporary stop which is used only when placing a new strip of stock in position, and the proper starting relation is required with the edge of the stock. By pushing the finger forward the location is obtained for the first operation, and after the pressure is released the spring forces the stop out of the way so that the stock can pass by this point.

Stamping Out Hacksaw Blades

The first operation in this die is the piercing of the two holes at *D* and *E*. In the proper positions in the die so that they will come directly under the punches, two small piercing dies are inserted. The purpose of this construction is to permit easy removal for replacement purposes. It will be seen that the positions of these piercing punches is such that one blank is skipped when first setting up the work. This is done in order to avoid bringing the piercing punches too close to the edge of the die.

The stock is fed forward after punching until it stops against the surface *F* on the block *G*. As the punch is carried down, the blank is formed and passes through the die in the usual manner. In this example only one side of the punch is guided in the die, so that it is necessary to back up the other side in the manner shown by means of the block *G*. This is clearly indicated in the sectional view. This method prevents the punch from springing out of place as it might do if the cutting action were all on one side of the punch. This condition is illustrated graphically in several examples.

At *K* the punch has just struck the work and forced it down on the die. At *L* the pressure is applied, and as the action is all on one side, the punch springs over in the direction indicated by the arrow. In order to avoid this action a hardened block may be placed as shown at *M*. This block is so arranged that it takes the thrust resulting from the action of the punch only on one side of the work. There are some cases when it is necessary to design a special punch like that shown at *N*. Here the punch enters the die and the heel *O* bears against the back of the die at *P*. Then as the punch proceeds down in the work, this portion acts as a guide so that there is no chance for spring in the punch.

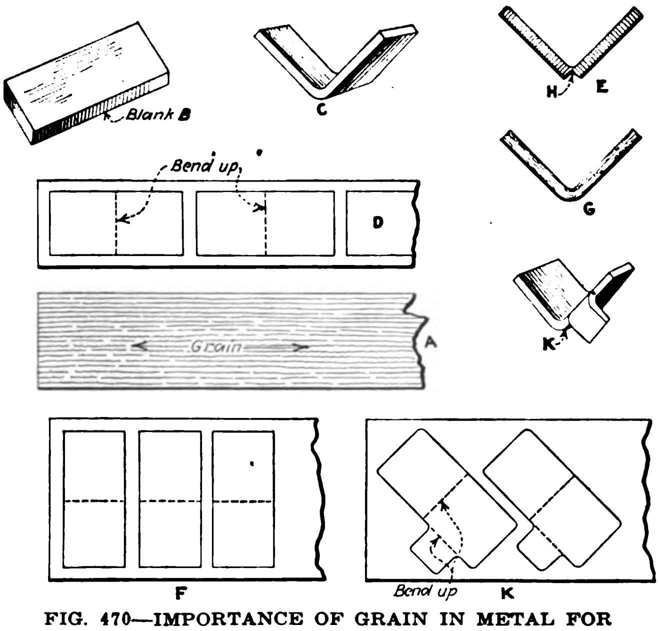


FIG. 470—IMPORTANCE OF GRAIN IN METAL FOR BLANKING OPERATIONS BEFORE BENDING

A layout of stock for blanking hexagon nuts is shown at *Q*. The edges of the stock are used for one pair of sides of the nuts, and the method of production is similar to that with the other progressive dies shown. The punch *R* produces a hole while the punch *S* forms a blank. The layout shown at *T* indicates that the only scrap produced in this blank is the amount indicated at *U* by the cross-sectioned area.

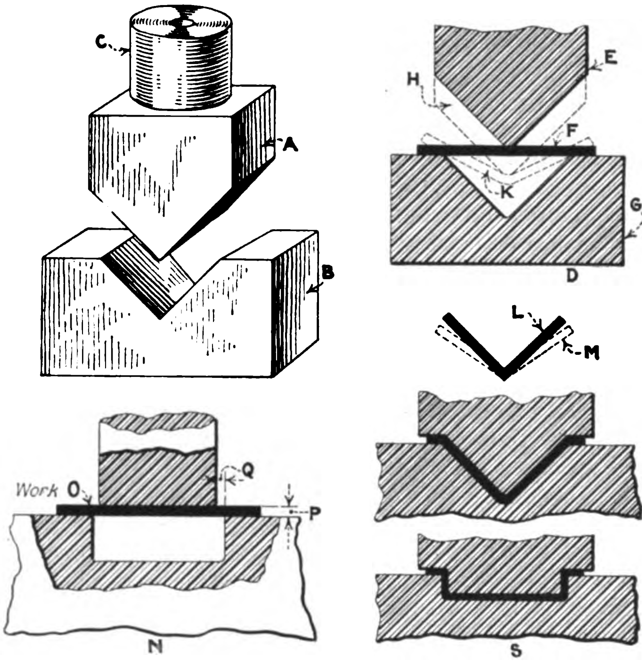


FIG. 471—SIMPLE BENDING OPERATIONS

The important points in connection with the design of bending dies will be taken up and illustrated by means of diagrams, as they can be more clearly shown in this manner. It must be remembered that when making a layout for a blanking die which is to be followed by a bending operation in which the work is shaped to some irregular form, the layout must be quite different from all the examples which have previously been shown, because the blanks for forming work when a bend of 90 deg. or so is required, must be laid out so that the bend will come across the grain of the metal as nearly as possible, in order to prevent the possibility of breaks or cracks while bending. In sheet-metal strips the grain of the metal always runs lengthwise of the stock, as indicated at *A* in Fig. 470.

Bending Dies

In order to bring out the point a layout is shown at *D* in which the blank *P* is to be formed to the shape shown at *C*. The grain of the metal would appear as shown at *G* in the end view after the bend, if the layout were made as shown. On the other hand if the stock had been laid out as shown at *F* and then bent as at *E*, the grain of the metal, which runs crosswise of the piece, would cause it to fracture as shown at *H*. It is not always necessary to follow this rule absolutely as some metals will stand bending better than others, but when any strain is to be brought to bear on the work after it is bent it is much better to keep this point in mind when laying out the blank for a bending operation.

Occasionally the shape of the work is such that an excellent layout may be made if the blank is turned at a 45-deg. angle like that shown at *K*. This is sometimes possible, and it has been found that a 45-deg. angle bend will seldom break unless the material is very fragile. An angle of 45 deg., however, seems to be about the limit at which the work can be turned, and it is not desirable to exceed this amount when making a layout.

Several simple diagrams of bending operations are shown in Fig. 471. At *A* and *B* are shown, respectively, a punch and die for bending the part *C* previously illustrated in Fig. 470. Dies of this kind are very simple in their construction and do not require very accurate workmanship while fitting. The die is usually mounted in a cast-iron shoe held on the bolster of the press, while the punch is held in the ram by means of the shank C. The diagram at *D* illustrates the method of bending a piece of work. The punch *E* comes in contact with the work *F*, which has been located on the die *G*. As the punch descends it takes the position indicated by the dotted lines at *H*, so that the blank is forced up on each end as shown at *K*.

When bends of this kind are being made, there is usually a certain amount of spring in the material, the amount of which is dependent to a great extent on its quality. If a piece is to be bent to 90 deg., as shown at *L*, it is likely to spring back after the bending operation until it takes the position shown by the dotted lines *M*. It is advisable, therefore, in designing a die of this kind to provide for such a contingency by decreasing the angle an amount which is usually determined by experiment. Occasionally it is found necessary to change the angle as much as 10 deg. in order to overcome the spring of the material.

In the example *N* a punch and die are shown for

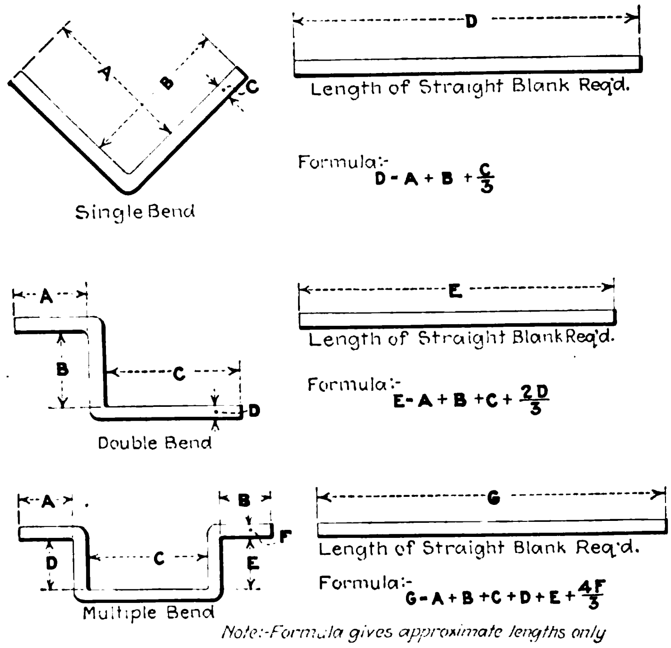


FIG. 472—TABLE FOR DETERMINING APPROXIMATE LENGTH OF BLANK FOR BENDING OPERATIONS

bending the U-shaped piece at *O*. Here the thickness of the stock *P* is the amount allowed between the punch and die all around, as shown at *Q*. It is evident that this amount will be necessary in order to permit the stock to pass by the sides of the punch. It is advisable to leave an additional amount of a few thousandths of an inch in order to compensate for variations in the thickness of the stock.

The punch and die shown at *R* are used for punching a U-shaped piece having two straight edges on the top. This is similar to the example illustrated at *A* except for the straight edges. Here also it would be necessary to make an allowance for the spring of the material. In the example *S* a punch and die are shown for a U-shaped piece of similar style having straight corners. These examples are given in order to illustrate the number of bends which can be made at one time in a bending die.

It is difficult to approximate the straight length of a blank required for a bending operation. The exact size cannot be determined by means of a formula. For this reason the bending die is usually made first, and after the correct length has been determined the blanking die is made to suit.

Rules for approximating the length of blanks required when bending operations are necessary are given in Fig. 472. The formulas given will serve very well for laying out blanking dies when a bending operation is also used. The exact size can be gotten only by obtaining a blank of proper length as determined by the bending die, and using this piece as a guide for the blanking operation.

How Do You Figure the Cost of Tool Work in the Shop?

BY A. W. FORBES

We hear frequent statements that it costs more to do tool work in the shop than to send it outside. Also we encounter statements to the contrary. When the tool work is done by men particularly hired for the purpose it is a simple matter to figure the cost, but in our case it is not so easy. No one is engaged here for tool work but most of the tools, with the exception of those regularly carried in stock by the dealers, are made by the regular production force.

It is necessary to have a production force sufficient to handle orders as they come in, especially as a large part of our product is special machines made for particular jobs. They are usually wanted in a hurry. This leaves frequent periods without work. Some of this time can be spent in making stock parts, but they require a considerable amount of material and so tie up more capital in purchases than is desired. As a matter of fact, we spend a considerable portion of this time in tool making.

Now how shall we figure the cost of this time? If the men were not engaged in tool making, it would be necessary to send them home, which has many bad effects because, in the long run, it is the pay per week rather than per hour that counts. In some cases, it might be necessary to pay as much for the 30 hours per week actually worked as for a full week. It is reasonable, therefore, to claim that all the time should be charged against the production jobs and tool making figured at no labor cost.

Most of us, however, would not go so far as this. But, in a case like this shop, I do not think that it is reasonable to charge even the full wages paid to the tool work, while the production work should bear the full amount of overhead and a little also for waiting time which the tool making utilizes.

Ideas from Practical Men

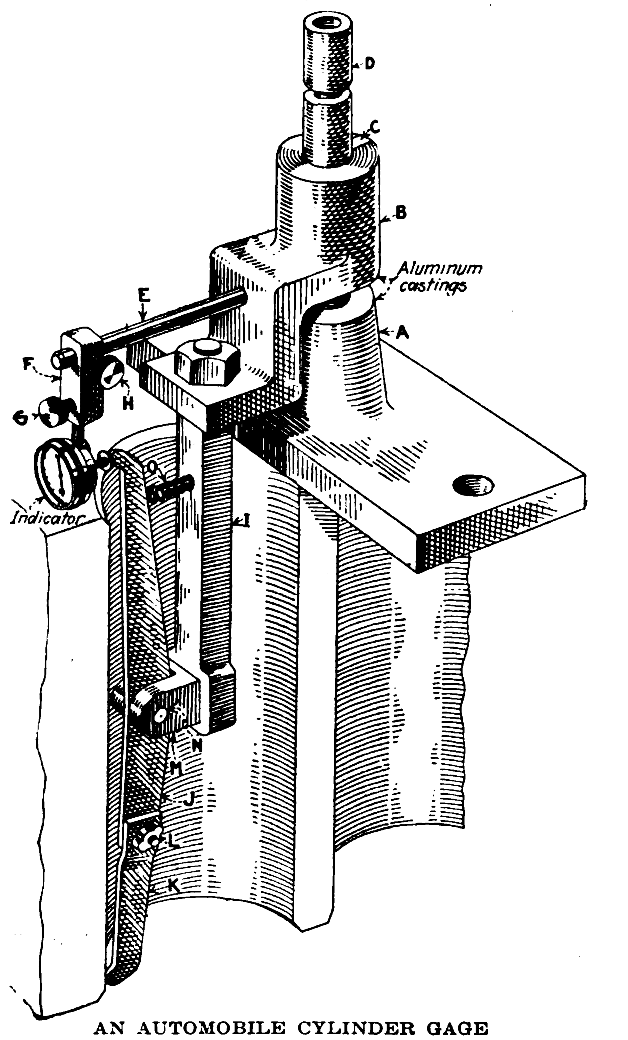
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Cylinder Gage

By H. A. Peters

The testing fixture or gage shown here is used for testing the perpendicular trueness of the bores of an automobile cylinder block. Any variation in this respect of the bores would mean either the wearing down of the piston bosses, the wearing of the piston pin bearings or the cylinder bores.

Referring to the diagram, the aluminum base of the gage *A* has a hardened and ground standard *D* pressed into it. This standard *D* is hollowed out to lighten it, as shown, and has a keyway running its full length.



AN AUTOMOBILE CYLINDER GAGE

Aluminum slide *B* is made a slip fit on standard *D* and is kept from turning by key *C*. Piece *I* is bolted tight in slide *B* at one end and has a forked piece *M* pressed into it at the other. This forked piece *M* holds gage arm *J* and allows it to pivot on pin *N*. To allow for adjustment the gage arm *J* is made of two segments, *J* and *K*, which are clamped together by means of the nut *L*. At the indicator end of arm *J* a tension spring *O* holds the arm in tension.

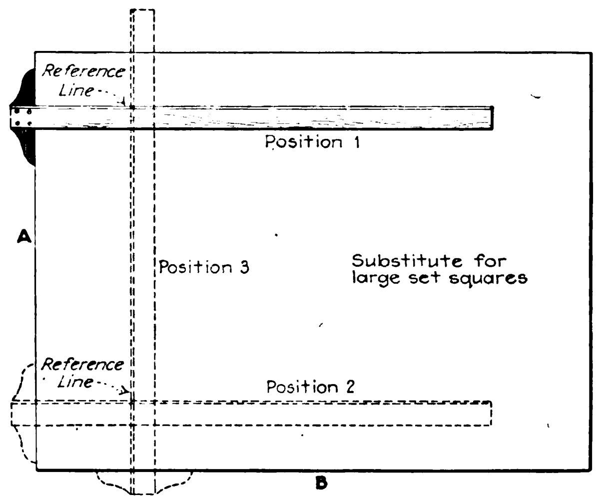
Block *F*, which holds the indicator in place with thumb screw *G*, is a slip fit on rod *E* and can be locked in position by means of thumb-screw *H*. To operate the gage, the base *A* is clamped to the cylinder block in a suitable position, the smaller gage arm *K* is then adjusted until it bears against the cylinder bore while the other end *J* bears against the indicator as the diagram shows. Variations of 0.0005 deg. can be ascertained by this gage.

A Drafting Room Kink—Discussion

By W. Roland Needham
Goodmayes, England

Referring to the article under the above title by Edward Heller which appeared on page 972, Vol. 56, of the *American Machinist*, it has occurred to the writer that those who do not possess or do not care to go to the trouble of making the little device described by Mr. Heller can secure reasonably accurate results without it.

For less frequent use than is contemplated in the original suggestion the alternative as per the accompanying sketch may be preferable.



SUBSTITUTE FOR LARGE TRIANGLES

With the T-square in position 1, mark where required a short line which crosses the junction between bevel edge of square and paper. Thus, as is indicated in the figure, part of the line is on the square and part on the paper. Now move square to position 2 and mark the paper by reference to the line on the square bevel. Then as shown by position 3, join the markings on the paper.

Of course, in case the edge *B* of the board, as well as that at *A* is finished true, and each is truly square with the other, even this simplification is unnecessary.

Old Lathe at the Bennington Machine Works

By Milton Wright

An interesting old lathe that dates from the period before the Civil War is shown in the accompanying photographs. It is an excellent example of home product, made at a time when the wits of the "old man" were often matched against market and transportation difficulties as well as the regular shop problems. Some time in the 40's the late Olin Scott established at Bennington, Vermont, a machine shop and foundry to do general jobbing and build machinery for the paper mills to be found in that section of New England. Though the founder has long since passed away the shop is still doing business in the original buildings under the name of the Bennington Machine Works.

As first established, the limit of capacity of the shop was represented by a lathe that would swing at most but about 42 inches and the proprietor soon found that this was too small to handle the large wheels and cylinders that came his way. He, therefore, set about building a bigger one from materials already at hand. Structural steel shapes were not then as readily available as they are now, so the foundry was called upon to furnish castings with which to build up the machine. Size was no barrier in the foundry. Most of the large molding was done "in the floor" and if the floor was not big enough there was all out doors available. The skill of the old time molder enabled him to make most any ordinary kind of a casting, including gears, without much in the way of patterns.

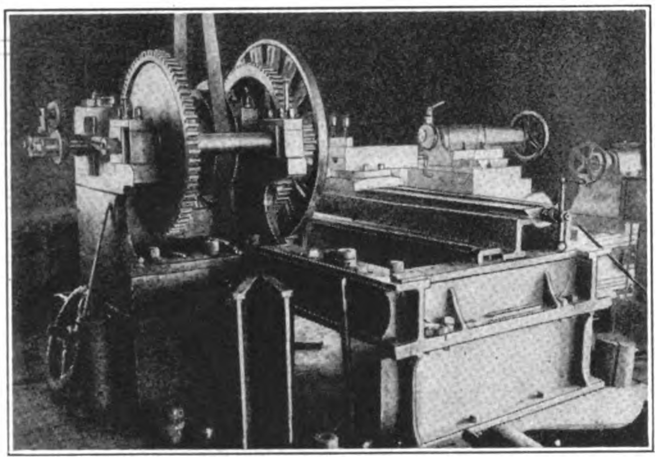


FIG. 1—HEADSTOCK OF HOME-MADE GAP LATHE

A bed plate upon which to build the head-stock was first cast. This was set in place on a solid foundation at the end of, and in line with, the bed of the smaller lathe before mentioned, but not attached to it. The head-stock was built up from this plate with the spindle parallel to, but considerably above, the spindle of the other lathe. The "carriage" consists of a slide-rest mounted upon suitable angle castings bolted to the bed plate and these castings can be arranged in any position desired by changing the bolts. The slide-rest is operated by a screw and has a cross travel the entire width of the lathe. The longitudinal travel is limited to the length of the slide, which is about twelve inches, and if longer cuts are required parallel to the spindle the rest must be reset.

A view of the head-stock is shown in Fig. 1, which also shows the manner of mounting the slide-rest. In Fig. 2 may be seen the entire lathe, showing how the tailstock is mounted on the bed of the smaller lathe. The tailstock has two main parts, one sliding upon the shears of the smaller lathe and the other one fitted to it. To turn long work upon centers the upper part of the tailstock is removed and the headstock of the smaller lathe raised upon raising blocks to line with the large spindle. The lower part of the tailstock with the slide resting upon it thus becomes the carriage of the combined lathe.

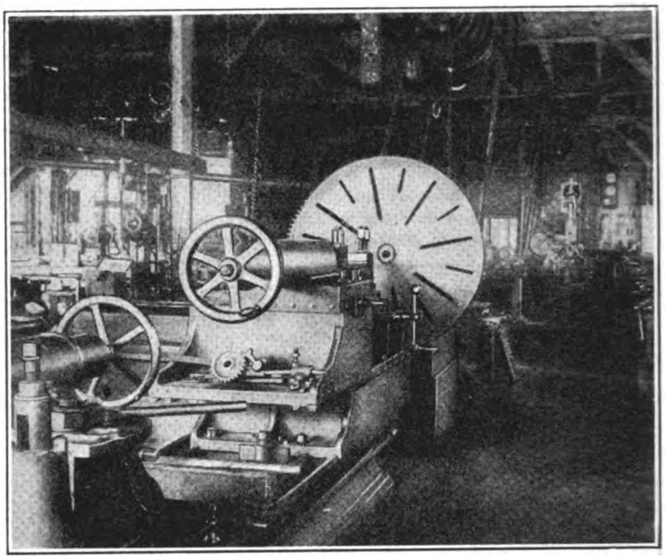


FIG. 2—VIEW OF LATHE FROM TAILSTOCK END

The lower part of the tailstock may be run out to project over the end of the smaller bed if desired, much like an ordinary gap lathe. The capacity of the lathe is about 7½ ft. swing in the gap and about 16 ft. between centers when used for smaller diameters. The record job was a fly wheel 7 ft. in diameter and weighing about 5,000 pounds.

To Make a Wooden Chuck Hold Tightly—Discussion

By M. E. Duggan

Referring to an article under the above title by Charles G. Spicer, page 419 Vol. 57 of the *American Machinist*, Mr. Spicer's method for reverse chucking is new to me. "There is," he says "no better method for this purpose than the one here described." As to this I can hardly agree with him, in fact "no better method" does not fit in when describing the things done in the pattern shop, foundry, core room, or machine shop. Pattern makers in general, however, will welcome any method or device that will make easy the reverse chucking of small pieces or patterns in the wood turning lathe.

"Take a piece of wood of suitable size and fasten it to the faceplate," suggests Mr. Spicer. Right here he knocks the whole job into a cocked hat. What is wanted is a "something" or a "method" that will eliminate this piece of wood because, in many instances, it takes a longer time to find the piece of suitable size, cut it on the band saw, fasten it to the iron face plate in the lathe and turn it to the required shape and dimensions, than the time required to turn and shape the piece itself.

The little iron face plate with its tapering shank to fit the hole in the lathe spindle, and with the "hole" and "counter-sink" in the center to receive an ordinary

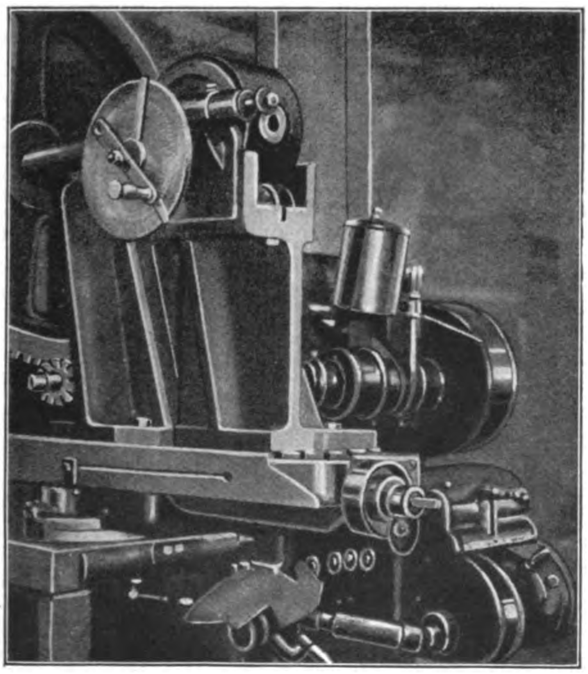
every-day-woodscrew, is part of the equipment of the wood turning lathe installed in every pattern shop. Now, with this little chuck I can turn and reverse chuck a piece about 14 in. diameter by 3 in. thick. But to do this I generally use my own outfit, because the tapering shank is a correct fit in the hole in the lathe spindle; the screw, a No. 16, is a press fit and true in the center hole in the face plate; and the threaded end projects 1¼ in. beyond the face plate. This No. 16 screw will grip and hold the wood equally as strong as two smaller wood screws.

The chucking is done in the following way: If the piece to be turned is 1¼ in. or less in thickness, I drill a $\frac{3}{16}$-in. hole half way through the piece. I put a backing collar of wood on the screw and face this off until the screw protrudes—say $\frac{3}{16}$ in. for a piece 1¼ in. in thickness. The piece to be turned is mounted on the screw, turned, and finished. Now comes the reverse chucking. A hole is drilled in the finished piece in the following way: A center is made in the turned piece by bringing the tail center against the wood. A $\frac{3}{16}$-in. hole, which is the diameter of the screw at the bottom of the thread, is drilled in the center of the piece. The piece is then taken off the screw and reverse chucked, on the $\frac{3}{16}$-in. hole. If the work is done in a mechanical way the piece should run true.

Cutting Large Gears in a Small Milling Machine

By W. C. Schellenberger

We recently had occasion in our shop to convert a number of power presses from belt to motor drive and the way we did it was to cut teeth in the periphery of each fly-wheel and drive direct from the motor shaft. There were 9 of the wheels in all and they ranged in diameter from 24 in. to 36¼ in. in outside diameter with teeth from 176-6 pitch to 143-4 pitch. The largest wheel weighed over 700 lb. As the largest wheel was the greatest problem we figured upon this one first and made our plans accordingly.



CUTTING A LARGE GEAR ON A SMALL MILLING MACHINE

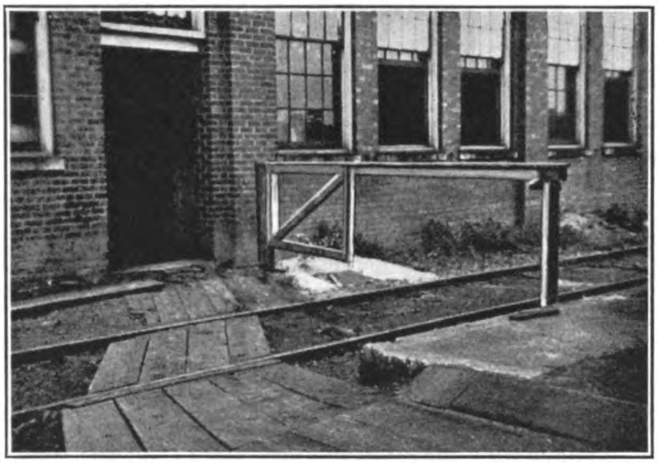
The only machine available in the shop for the work was a No. 2 LeBlond milling machine, which we rigged up to cut the teeth from the under side of the wheel, as shown in the illustration. We made two pedestals to support the wheels in bearings, seeing to it that they were high enough to swing the largest wheel and leave sufficient space beneath it for the cutter. A third pedestal was made to support the dividing head. The two main pedestals took all the weight and the thrust of cutting so as to relieve the dividing head of all duty except that of spacing.

As practically all of the wheels required an odd number of teeth for which there was no index plate available, we were obliged to make up special plates in advance. Though the job required a deal of rigging up, the actual time of cutting was a surprise. With a spindle speed of 35 r.p.m. and a table feed of $\frac{1}{32}$ in. per rev. we were able to run a cut over the width of the wheel in 2½ minutes. The entire time of cutting the largest wheel was but 7½ hours.

Safety Gate for Railroad Crossing

By J. Bainter

At the plant of the Cincinnati Planer Co. in Oakley, Cincinnati, Ohio, a railroad siding that comes in from the front of the plant runs parallel to and quite close to the side wall on its way to the unloading platform at the rear of the building. In this wall there is a door through which the truckmen most frequently pass on their way to a storage yard for castings. Since a truckman coming out of the shop cannot see up or down the railroad track until he has actually passed the door, there is always present the danger of accident from locomotives or cars that are being switched into the siding.



GATE FOR GUARDING RAILROAD CROSSING ON A SIDING AT THE CINCINNATI PLANER CO.

To protect the workman, a safety gate was made which would automatically guard him from harm. As can be seen in the accompanying illustration, the gate is simple enough. It is mounted on a post at the side of the door toward the front of the shop, and consists chiefly of a long bar that extends entirely across the railroad track. The outer end of the bar is normally supported on another post and rests in a V, from which it can be readily pushed.

When a car is backed into the siding, it comes from

the right and strikes the extended bar so as to push the gate shut. Should a truckman be coming out of the door just at that time, he is merely pushed back and held by the gate from walking further and on to the track. Since there is plenty of room so that he is not pinched between the gate and wall, there is but little danger of injury to him, such as would certainly occur if he walked directly in the path of the moving car.

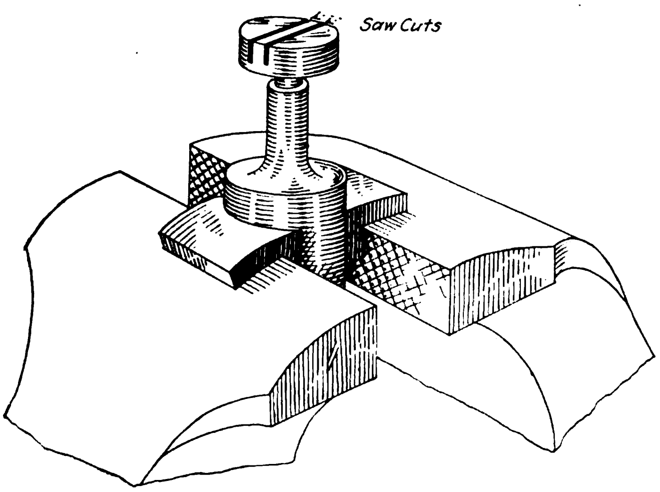
The gate stays in its closed position until the locomotive has spotted the car at the platform and left the siding. It is then placed in the open position, so as to be ready for the return of the locomotive for removing the car or bringing another car. The gate has been quite satisfactory, and it has given a considerable feeling of safety to the men that must use the exit on the railroad tracks.

Machining Woodruff Keys

By R. McHenry

In a jobbing shop it is often necessary to make one or more Woodruff keys. The job may require them to be of bronze, machine steel, tool steel or other material and perhaps of greater or less than standard thickness. In any case, I find machining them in a lathe to be the most satisfactory method.

First, a piece of round stock, slightly larger in diameter than twice the raidus of the key to be made, should be chucked so that an inch or so will project from the chuck jaws. The stock should then be turned to a diameter equalling twice the radius of the key, or in other words to the diameter of the keyway cutter. Next



MAKING WOODRUFF KEYS IN A LATHE

make a deep groove with a parting tool at a distance from the end of the stock slightly more than the thickness of the finished key.

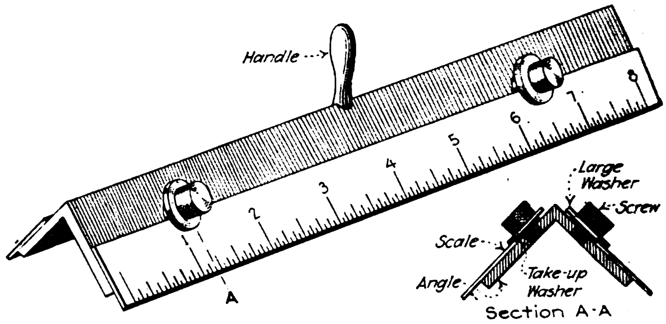
More cuts are now taken until the rod is necked out, as shown in the sketch, leaving sufficient room for the anvil of a micrometer. The inner side is carefully faced off smooth with a side tool and the disk is then reduced to thickness by facing the outer end of the stock, measuring the thickness with the micrometer.

After chamfering the edges of the disk with a fine file, the stock is removed from the chuck and held upright in a vise. Two hacksaw cuts parallel to the axis of the stock will now produce two finished keys that need only a trifle of burring with a file to be ready for service.

Novel Scale Holder

By P. A. Daschke

Designers and others engaged in laying out accurate work find it advantageous to have a number of variously graduated scales on hand. By means of the holder here shown scales of different graduations can readily be held, the holder thus forming a triangular scale rule in itself. In this way the graduated sides are brought



HOLDER FOR DRAFTSMEN'S SCALES

close to the work; a distinct advantage in laying out accurate measurements. As the scales become worn, new ones can easily be inserted or replaced with others of different graduations.

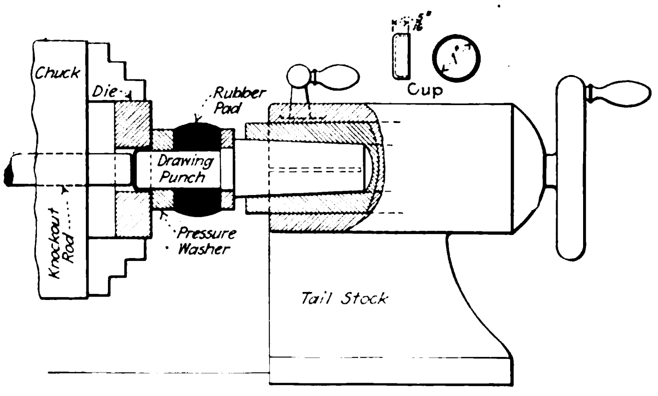
Procure any suitable metal angle, tap it on each side for two small machine screws so that the scale projects a trifle beyond the leg of the angle. Provide two small take-up washers the thickness of the scale, two large clamping washers and two round or knurled head machine screws for each side of angle. By this method of fastening the scales do not become mutilated. A small stock handle may be placed in center of holder to facilitate handling.

A Drawing Job in a Lathe

By S. A. McDonald

In a small jobbing shop, which did not include a punch press in its equipment, a lathe hand constructed the lathe die, illustrated in the sketch, to draw up some cups from 0.0312 in. brass, 1 in. in diameter by $\frac{5}{8}$ in. deep.

He first turned up a piece of cold rolled steel to fit the tailstock of his lathe and the other end he turned to the diameter of the inside of the cup. Two washers were then turned up, one a driving fit on the punch and the other a sliding fit with one face polished to act as a pressure ring. Out of some sheet rubber he made the pressure pad. Next he chucked a piece of cast iron,



DRAWING SHELLS IN THE LATHE

faced one side and bored a hole to the outside diameter of the cup, rounded the corner, made a circle on the face for locating the blank and gave the face and hole a high polish. His punch and die were now ready for work.

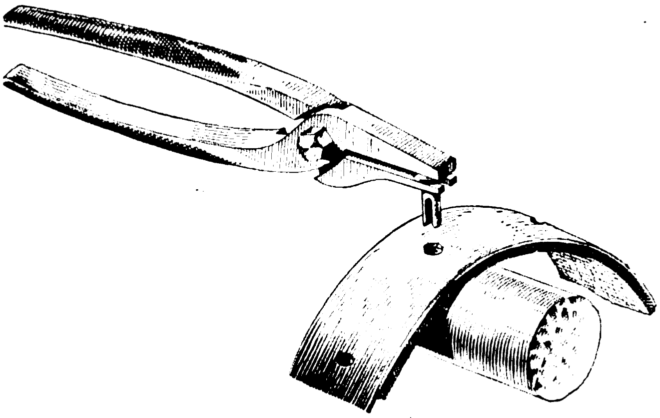
By locking the spindle with the back gears and clamping the tailstock, he converted his lathe into a screw press. The size of blank was determined by trial and was cut out with shears. Locating the blank by the scribed circle, the tailstock was screwed out so that the pressure washer gripped the blank, compressing the rubber pad until the punch drew the blank into the die. On withdrawing the punch the rubber pad stripped the cup from the punch and, by using a knockout bar through the lathe spindle, the cup was knocked out of the die.

The boss was so pleased with the results that he had the lathe hand make up a blanking die in the same way. The remarkable thing about the whole job was that the lathe that made the cups was the only tool used in making the die.

Tool for Holding Split Rivets

By G. A. Luers

Where a great many split rivets are used, as in the relining of brake bands, the tool shown in the accompanying sketch will prove of great value as a time economist and will also save the temper of the workman by eliminating the bruised fingers which are bound



PLIER FOR SETTING RIVETS IN BRAKE BANDS

to ensue if he tries to hold the rivets in the ordinary way while starting them into the band with his hammer.

The tool is made from an ordinary pair of flat-nosed pliers by grinding down one jaw to about $\frac{1}{16}$ in. in thickness and then filing a slot in the thin jaw to take the body of the rivet. The rivet is then grasped as shown and started in the hole by striking the heavy jaw of the pliers directly over the head of the rivet. The tool is of equal advantage in the upholstering department for setting upholstery nails.

Soliloquies of Old Mac

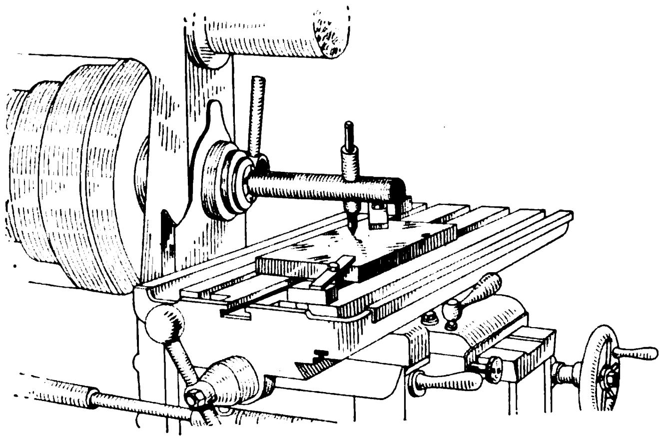
Turpentine is the best lubricant to use on a drill when drilling holes in flat springs or similar pieces of hard steel. Take a shallow pan (the cover of a tin can is convenient) fill it with turpentine and lay the work in it. You can then drill through the whole business and throw the cover away.

Handy Laying Out Tool

By Joseph Cole

A very satisfactory method of laying out flat work is to clamp it to the table of a milling machine where it can be moved in either direction by operating the feed screws. It is necessary, of course, to provide means for holding the prick punch in a fixed position while moving the work. The accompanying illustration shows a simple tool made by the writer for holding a prick punch for laying off dies on a milling machine table.

The tool consists of a piece of tool steel turned on one end to fit the collet of the milling machine and at the



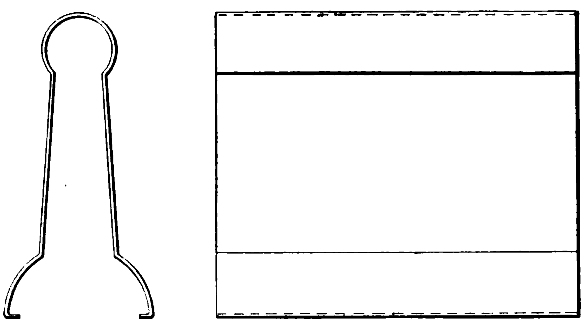
LAYING OFF WORK ON THE MILLING MACHINE

other end it has a hole bored at right angles to its length. Into this hole is driven a ground and lapped bushing, holding a sliding prick punch. The use of this tool is obvious to those who could use it. The sketch tells the rest.

Device for Handling Small Work on Milling Machine

By R. A. Follensby

The sketch shows a device made by the assistant foreman of a milling department for the purpose of picking up thin pieces from the vise of the milling machine. When these are covered with chips and oil they are quite difficult to get hold of with the fingers and, though this tool is very simple and may be made in a few minutes' time, it increased production on the job by



DEVICE FOR PICKING UP WORK FROM THE MILLING MACHINE VISE

about 10 per cent because of the ease of handling. A description of the device is unnecessary. It is made of thin spring steel and the shape should be made, of course, to fit the job in hand.

Editorial

TO KEEP an employee when he has become too old or feeble to be really useful shows human sympathy. To keep a machine when it is old or out of date shows lack of business sense. On the other hand, nobody would think of throwing a good machine into the discard because it has slipped a cog or caused some other kind of trouble, while firing a man because there is temporarily something wrong with his headstock or because he is set for the wrong speed is still quite common.

What's Wrong With the Railroad Shops?

THERE IS a general impression that now that the railroad shop strike is over, the problem of maintaining railway rolling stock in good running order is practically solved. People seem to think that all that is necessary is for the shops to work a little harder to catch up with the repairs that were delayed by the strike. Unfortunately many of the higher-ups in railroad circles share this feeling which is entirely unjustified by the facts.

Any engineer or shop man who has ever visited a railroad shop cannot have failed to take away with him the impression of a journey back into the dark ages of machine shop practice. Archaic machine tools, inadequate equipment, poor tools, obsolete methods, ingenious but expensive makeshifts can all be found in any railroad shop. Who is at fault? This is a question that is hard to answer definitely because of the many departments involved and the inter-relation of the various shortcomings.

The labor union rules that limit output and circumscribe the duties of each craftsman are responsible for a small part of the trouble. The remarkable vitality of traditional methods in performing certain jobs and the lack of knowledge of current practice in other machine shops go hand in hand as an indictment of shop management. On the other hand must be considered the necessity for better tools and equipment. With those provided in the average railroad shop by pinchpenny and shortsighted financial management, it is a living wonder how the mechanical department manages to do as well as it does.

The purchasing department, which is frequently permitted to overrule the specifications of the manufacturing department, must shoulder the blame when it procures cheap substitutes that do not meet the requirements. Back of that is the headquarters policy that permits such an uneconomic and inefficient practice to be continued. Going one step farther, we come to the insanely drastic bureaucratic regulation which has done its level best to starve the railroads to death until very recently. If you examine this pyramid of errors, you find that it is so constructed that alibis are easy to construct for every one concerned. Unfortunately, alibis don't repair locomotives. Neither do they excuse incompetence, ignorance nor sloth.

With these conditions clearly in mind, the editorial staff of the *American Machinist* has conducted an investigation with the purpose of pointing out the mistakes that can be corrected and suggesting ways of correcting them. The first article appears in this issue and the others will follow at short intervals. A good many toes are going to be stepped on before the series is ended, but it is our hope that the criticism will be taken in the spirit of constructiveness that prompts it and that a general improvement in railroad shop methods, management, and equipment will be effected by a clear vision of what is actually going on.

Machines Versus Immigrants

UNDER THE above title the *New York Tribune* says some very true things on a subject which has been in our mind for some time. We had planned to editorialize upon it but when we saw it so well handled in the daily press we decided to let an editor whose opinions can hardly be said to hold any bias for machinery builders, as might be said about our own, tell the story. Note particularly the last paragraph.

"The new automatic phones mean a better, temperproof telephone service for the customers. They mean, in the end, a loss of jobs to many operators. They mean a saving in operating cost to the companies. These are the first direct effects of this new machine —effects of a kind that has been happening decade by decade in every direction for over a century now.

"For a long while laborers fought the new machines, seeing only the jobs lost. That was natural enough. Only slowly has the truth been perceived and accepted that by machines the total product of man is enormously increased and thereby shorter hours and a higher standard of living are made possible. Upon the temporary hardship of jobs lost and readjustment compelled rises the whole structure of our modern civilization, eight-hour day, bath-tubs, "movies," newspapers, what not.

"There is one other important aspect of this continuing substitution of machines for hands and brains. The restriction of immigration now in operation is felt to be sound by every American who cares for the future of his country. But there is constantly raised the problem of how the country is to obtain sufficient labor if the European source is thus closed. Part of the answer lies in just such machines as the automatic phone. To be sure, it is overall labor of the roughest kind that is most urgently needed. The phones will not release ditch diggers or road builders.

"But the movement toward automatic machinery is a continuous one and its speed depends largely upon necessity. Our subway trains are now operated by two or three men. The old ticket chopper is a figure of the past. In the B. R. T. trains one man announces the stations in all the cars by megaphone. The electric irons and the mechanical dishwashers have not solved the whole kitchen problem, but they are on the way. What we can feel with every confidence is that the

product of our labor is no fixed sum. Each year it grows whether the total number of laborers grows or not.

"We must expect shiftings. Above all, once machinery has reduced the man power needed in a going industry the superfluous workers must shift into other lines. Otherwise the whole gain of machinery to society is utterly lost. The uneconomic situation in the mines today is largely due to just such a refusal to shift. But granted time for these readjustments there is no reason why the labor needs of the country cannot be met without letting down the immigration bars. Let us have hordes of machines rather than hordes of foreigners difficult to assimilate and holding a peril to the whole structure of our country."

Telling Workmen the Truth About the Company

SPEAKING last week before the Mechanical and Industrial Engineers in Chicago, the following statement was made by John Calder: "Comparatively few employers realize as yet the wonderful potency of just telling their people the truth about any situation. Wage-earners are square and they want to be fair, but they must be shown."

That education is the salvation of the world applies particularly to industry and, the sooner employers realize the fact, the sooner the industrial modern Sword of Damocles—labor troubles—will be eliminated. Knowledge is an eagerly sought and highly prized possession and even the slightest knowledge that contains a ray of hope for the betterment of his economic status is eagerly grasped by the worker. This fact has been a sinister weapon among radical leaders while the employers have failed to recognize it. Just why the employers have been so slow in realizing that ignorance is at the base of most of the ill feeling shown by employees is hard to understand. Perhaps they need a little educating themselves.

The writer of this editorial has seen several workmen estimating the manufacturing cost of the product upon which they were working, leaving out entirely the item of overhead as it was something that so far as they knew had never existed, and showing that the company was making a profit of several hundred per cent while, as a matter of fact, it was under ten per cent. Any employer who will take the trouble to make an investigation will find that those who know the least about the cost of operation are usually the ones who make the most trouble.

The interests of the employer and the employee are identical. Manufacturing and other enterprises are operated for the common good—to enable the worker to achieve economic independence by the fruits of his labor, and to return a fair interest on the money with which the industry was established. When the worker has been shown that he is getting a fair share of the profits, then the entire organization will pull together in peace and harmony and the problem of the age will have been solved.

When buying ceased and prices began to tumble, Swift & Co. called their employees' committee in and showed them the books, as a result of which the committee recommended a general decrease in wages of 15 per cent. Those employers who are searching for a permanent solution of their labor problems will not underestimate the value of this example.

Are You Going to Vote This Year?

NEXT TUESDAY is Election Day. Although the principal prize is not at stake this year there will be plenty of other contests worth watching. The Republicans will try to read an indorsement of the present Administration into the results of the voting, the Democrats a sign of discontent and an augury of hope for the big fight two years hence.

Indications are that the vote in many sections of the country will be light, a sad commentary on the sense of duty of the average citizen. Are you in the indifferent class? Did you forget to register or was it too much trouble? If so, you should be the last one to object if the wrong man wins in your community and you are sentenced to another period of futile protest.

In this day and generation when the forces opposed to law and order are gradually growing more confident and insolent, it is the solemn duty of every law-abiding citizen to go to the polls and cast his vote, even if he takes no more active interest in political matters. Many people feel that the political bosses are so firmly intrenched that it is a waste of time to vote. They overlook the fact that under our form of government a boss is in power only so long as the indifference of his opponents permits.

Cutting Oils vs. Soap Water

A SHORT ARTICLE by H. B. Egg appears in this number under the above title. Apparently the writer is not satisfied with the knowledge as to *what* is being done; he seems to want to know *why* it is being done. This spirit of wanting to know, of wanting to have every-day practice based on some fundamental principle is to be recommended. If more people would show this dissatisfaction with the blind following of other people's action, if more mechanics would open their eyes and see, not merely the outer surface but also the inner working of things, the mechanical arts, and especially machine shop practice, would be on a much higher level than they are today.

Even the combined observations of all good mechanics, however, would not be sufficient to settle such an important question as the one put by Mr. Egg. Such problems should not be solved by experience, but by experiments, though of course, the experience of many people will greatly help to reduce the amount of experimentation required. Here is a subject worthy of the attention of Engineering Colleges, of Universities and other institutions of learning and research.

Just Suppose

JUST suppose that you were one of the faithful, square deal railroad shop machinists who stuck to his job and kept on running the same wabbly old boring mill your father had run before you. And suppose that accuracy with that machine was only obtained through a combination of good luck and the skill of long experience.

What would you say if the foreman came up one day and told you that a new boring mill has been ordered and that you were to run it when it arrived? Of course such things only happen in story books, but—

Just suppose.

Shop Equipment News

Sundstrand Stub Lathe

A machine intended especially for turning such work as automotive pistons and designated as a stub lathe has recently been placed on the market by the Rockford Tool Co., 2400 Eleventh St., Rockford, Ill. The machine can be applied to production work on many other jobs, such as turning automobile wheel hubs, gear blanks, steering knuckles, pulleys, bushings and ball joints. The swing over the carriage is 8 in., while the maximum

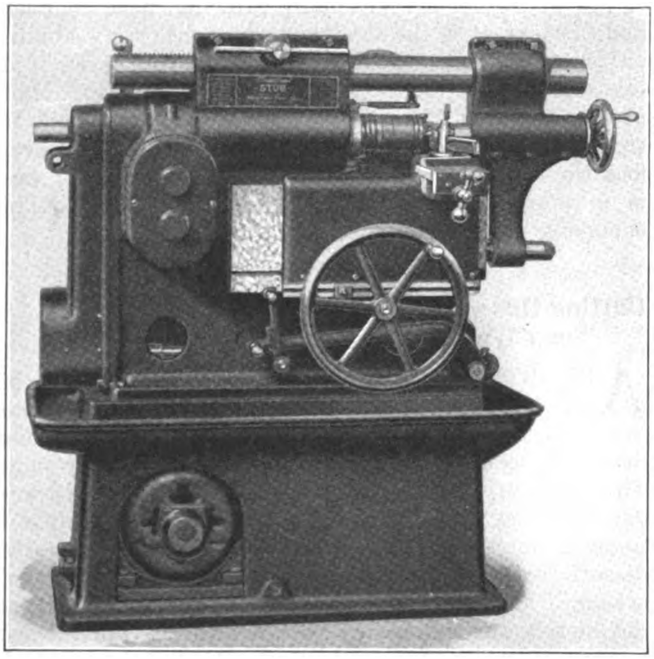


FIG. 1—SUNDSTRAND STUB LATHE

capacity between the centers is 12 in. One operator can run two machines simultaneously, and on many jobs three machines can be operated by the same man.

One of the most noticeable features of the design, as can be seen by referring to Fig. 1, is the fact that the carriage ways and the headstock are one casting. In this way great rigidity is obtained, as is necessary under the heavy cuts that are taken. The bed is well ribbed and braced. It is so designed that chips fall from the carriage into a pan provided for that purpose, and ample room is allowed as a clean-out space at the back of the machine.

The spindle is of large diameter and runs in phosphor-bronze taper bearings that are lubricated by wick feed from an oil reservoir supplied from sight-feed oil cups. The front spindle bearing is 6 x 4¼ x 3¼ in. in size and the rear bearing 3⅜ x 4 in. The take-up device for both bearings is adjusted by means of a single nut at the rear of the spindle. The nose of the spindle is 4 in. in diameter and has two threads to the inch. The hole through the spindle is 1 $\frac{31}{32}$ in. in diameter, while the taper hole is 2 $\frac{11}{32}$ in. in diameter at the large end and tapers ½ in. per foot. The spindle is driven by means of a bronze wheel and worm provided with ball thrust bearings. The gears regularly furnished with the lathe give spindle speeds of 40, 50, 65, 85, 110 and 145 r.p.m. The spindle is 44 in. above the floor. Provision is made for mounting an air cylinder and a quick-acting draw-back device.

The tailstock is very heavy and is clamped to a large overhanging arm supported by means of a stud protruding from the bed. This arm is 3½ in. in diameter and is so arranged that the tools can be clamped on it for doing operations such as facing and boring the open ends of pistons and center drilling. Adjustment can be made by means of a rack and pinion, the rack being cut on the top of the overhanging arm. A No. 4 Morse taper is employed in the tailstock spindle, which is 2⅜ in. in diameter.

A large diameter screw having a lead of 1½ in. per revolution of the hand wheel is provided in the tailstock. The spindle is of sufficient diameter to prevent springing, and it has a longitudinal adjustment of 5 in. The tailstock spindle bearing is split for its full length and held in position by screws that may be adjusted to care for wear that occurs.

The arrangement of the carriage is worthy of note. It is 18 in. long and has bearing for its full length on the 8-in. face on the front side of the bed and on a 4-in. angular surface on the top. Its extreme travel is 8 in. An angular gib at the bottom of the carriage is provided to take up wear, and adjustment can be made from the front of the machine. The front toolslide has stop screws underneath it for adjustment of the tool and the slide is of sufficient width so that several tools can be clamped on at one setting.

By referring to Fig. 2 the arrangement of the rear tool may be seen. This tool is mounted on a slide having a cross travel of 4 in., as well as ample sidewise

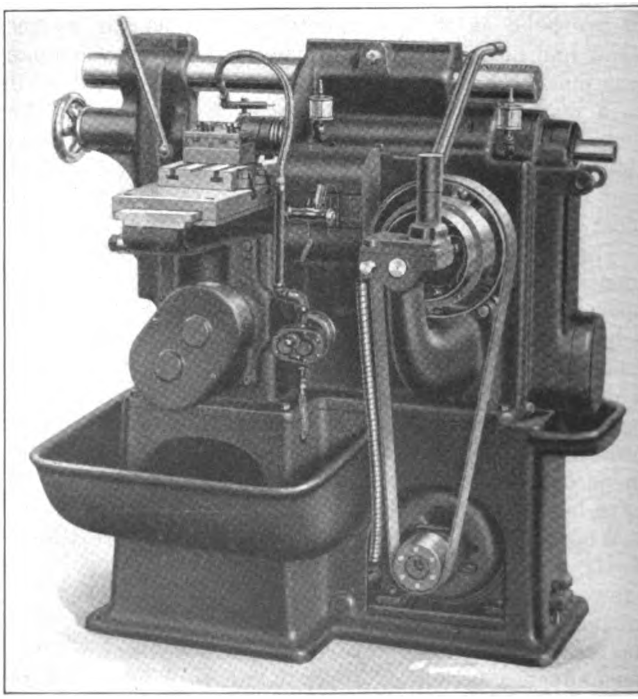


FIG. 2—REAR VIEW OF STUB LATHE

adjustment. The front and the rear tools can operate simultaneously, so that multiple machining operations can be quickly performed.

The feed is driven from the spindle by a chain and pick-off gears located at the headstock end of the machine. The standard gears furnished provide feeds of 0.020, 0.030, 0.038, 0.050, 0.066 and 0.090 in. per revolution of the spindle. The feed arrangement to the carriage and the rear tool is driven through worm gearing with the worm submerged in oil. To engage the feed the worm is lifted to the wormwheel by a handle located at the front of the machine.

The wormwheel is keyed on the pinion shaft which drives the carriage, so that no gearing is required in the apron. On this shaft is a hand wheel measuring 15½ in. in diameter. To trip the feed a mechanism consisting of a dog on the carriage operates the feed lever and automatically disengages the worm from the wheel. It is stated that very accurate stopping of the cut can be made.

Power is transmitted from the motor through a short 4-in. belt. A 5-hp. motor running at 1,800 r.p.m. is regularly furnished and is fastened on a pivoted frame or plate inside the bed and entirely out of the way of the operator. An adjustment is provided for the tension of the belt. A friction clutch pulley is located at the back of the machine and mounted on roller bearings, with the starting handle conveniently placed for the operator when he is in his proper position at the front of the machine.

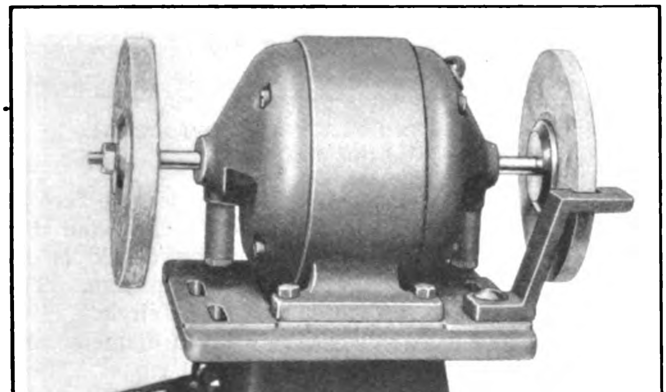
An oil pump driven from the main drive friction pulley is provided. The tank for the cutting lubricant is located in the bed below the chip pan. The machine requires a floor space of 46½ x 33½ in., a small space in consideration of the capacity of the machine. The net weight with the motor is 3,000 pounds.

Blount "Special" Combination Bench Grinder and Buffer

A plain-bearing, motor-driven combination grinder and buffer of the bench type, designated at the "Blount Special," has recently been placed on the market by the J. G. Blount Co., Everett, Mass. The tool is suitable for light work in garages, repair shops and other places in which grinding and sharpening operations are required.

The motor with which the machine is equipped is a standard Westinghouse single-phase motor giving ¼ hp. at 1,800 r.p.m. It can be supplied either for single-phase alternating current of 110 or 220 volts and 60 cycles, or for direct current of 32, 110 or 220 volts. The ground spindle runs in wick-oiled bronze bearings and carries a 6 x ½ in. grinding wheel and a 7 x ⅜ in. sewed buffing wheel.

The base of the machine carries a cast-iron toolrest, and is slotted so that guards can be fitted for the wheels. If it is desired to use the machine as a small power unit, a 2-in. V-belt pulley can be furnished on the spindle between the flange and the motor bearing. A flexible cord and plug are furnished so that the machine can be attached to the nearest circuit, and yet be readily portable. The weight of the machine is 42 lb. net, and 60 lb. when boxed for shipment.



BLOUNT "SPECIAL" BENCH GRINDER AND BUFFER

C.L.P. Portable Electric Drills

A line of portable drills has recently been placed on the market by the C. L. P. Electric Co., 62 Dey St., New York, N. Y. Although larger sizes of drills will be added, at present ¼ and ⅜ in. sizes are made.

The casing of the drill is of aluminum. The weight of the ¼ in. machine is 6 lb., while that of the ⅜ in. is 14 lb. Universal motors are used in both machines, and can be furnished for either 110 or 220 volt current. The armature runs on ball bearings. A fan is provided for air cooling the motor, the intake being at the rear end. The cable connection to the drill is simple, so that the cable can be removed without disturbing any inside connections. The units of the drill are so arranged as to be easily assembled and dismounted.

The drill is equipped with a three-jaw Jacobs chuck that is threaded to the end of the spindle. The chuck can be removed without disturbing any part of the drill. Extension spindles can be supplied for drilling in inaccessible places. Because of the offset position of the spindle, holes can be drilled close to a corner. The spindle has a ball thrust bearing and bronze radial bearings. The oil holes through which the gears and

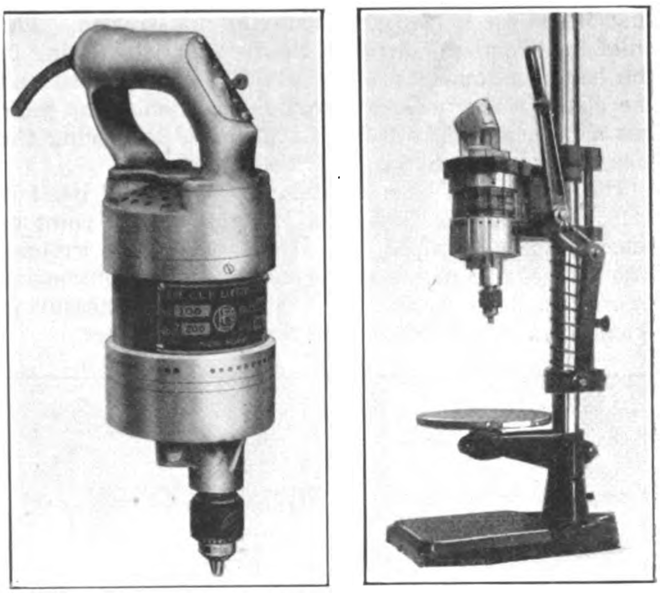


FIG. 1—C.L.P. ¼-IN. PORTABLE ELECTRIC DRILL AND STAND

lower bearings are lubricated are provided with self closing devices so that the oil is retained and dirt is prevented from entering.

At the left side of Fig. 1 is shown the ¼-in. machine. It will be noted that the large handle at the rear of the motor is equipped with a switch that stays in either the on or off position, and yet is so placed that it is always within easy reach for starting or stopping the motor. On the right side of the illustration is shown

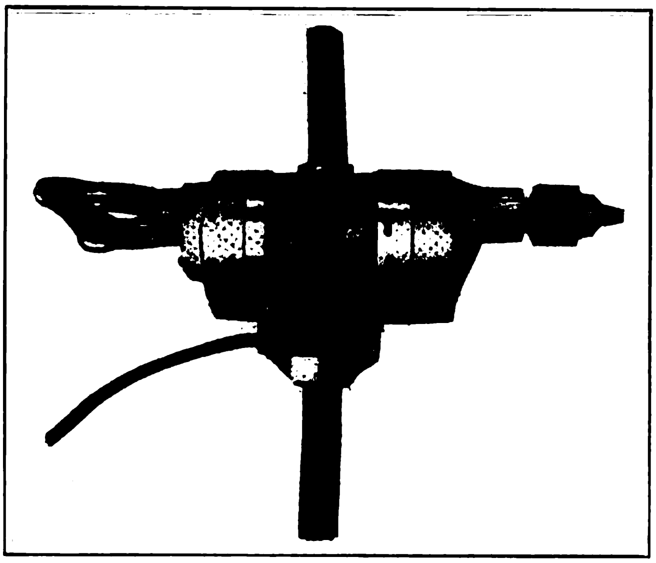


FIG. 2—C.L.P. ⅜-IN. PORTABLE ELECTRIC DRILL

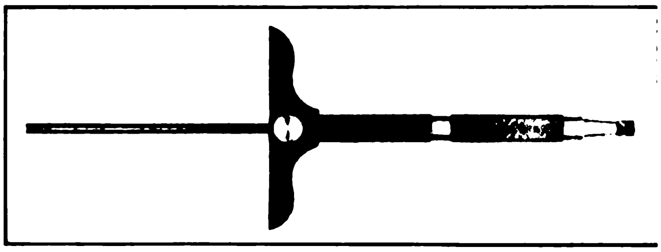
the stand that can be furnished when it is desired to do precision drilling on a bench. The usefulness of the tool is thus greatly enlarged.

The ⅜-in. drill is equipped with two side handles as well as a grip handle, as can be seen in Fig. 2. The switch is placed in one of the side handles and is completely encased in a fiber covering. Each machine is furnished with a plug and 10 ft. of cable.

Starrett Spring Depth Gage

The L. S. Starrett Co., Athol, Mass., has recently placed on the market the No. 48 spring depth gage that is shown in the accompanying illustration. The chief feature of the device is the fact that the spring in the barrel automatically forces the rod downward and the clamp screw locks the rod in position. The gage has a capacity up to 3 in., its principal use being the measuring of the depth of drilled holes.

The gage has a base 2⅛ in. long and the rod itself is ⅛ in. in diameter. The base and the contact point of the rod are not lapped, but are tempered and ground. The contact end of the rod is square instead of convex, in order to make it easier to manipulate when measuring from a plane surface to a very narrow shoulder.

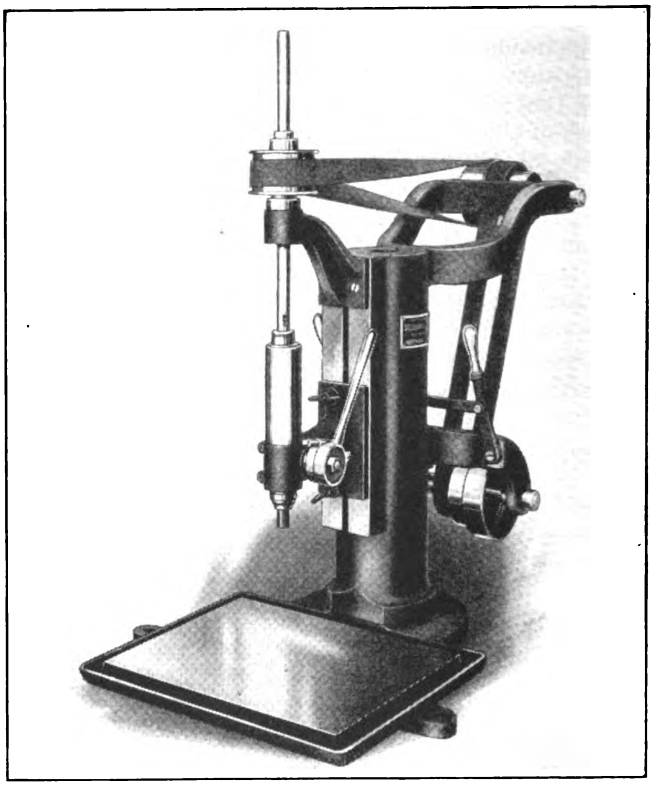


STARRETT SPRING DEPTH GAGE

Sigourney No. 1 Bench Drilling Machine with Plain Bearings

The Sigourney Tool Co., Hartford, Conn., has added to its line of sensitive drilling machines the No. 1 bench-type machine shown in the accompanying illustration. This machine is similar in design to the concern's ball-bearing, high-speed drilling machine, but is intended for slower speeds. Except for a ball thrust bearing to take the drilling pressure, the parts run upon plain bearings of bronze. The normal capacity is for drills up to $\frac{5}{16}$ in. in diameter, although larger can be carried. A chuck is employed for holding drills up to $\frac{5}{16}$ in. in diameter, although for larger sizes taper-shank drills are used.

The spindle is not enclosed. It has a taper hole to take a No. 1 Morse taper shank. The vertical movement of the spindle is 2¼ in., actuated by a rack and pinion with hand lever. The spindle is balanced by a coil spring concealed in the case of the spindle bracket. A clamp stop is provided to regulate the depth of the hole drilled.



SIGOURNEY NO. 1 PLAIN-BEARING BENCH DRILLING MACHINE

The head may be adjusted vertically upon the face of the column through a distance of 6 in., and the maximum height attainable under the chuck is 8¾ inches. The table is 10½ by 14 in. in size. The machine will drill to the center of a 13-in. circle.

The tight and loose pulleys are 6 in. in diameter and are intended to run at a speed of 450 r.p.m. Three changes of spindle speed are available through the three-step cones and belt. All pulleys are balanced. The belts are endless and the machine is shipped with belts in place, ready for use. An overhead countershaft can be furnished, although ordinarily none is used because the machine is run direct from the lineshaft.

The net weight of the machine is 170 lb. Boxed for export shipment it weighs 300 lb. and occupies a space of 20 cubic feet.

Pratt & Whitney Duplex Hand and Automatic Centering Machines

A double-ended centering machine for handling at high speed work on small shafts and similar parts has recently been placed on the market in both the hand-operated and the automatic types by the Pratt & Whitney Co., 111 Broadway, New York, N. Y. The hand-operated machine, which is illustrated in Fig. 1, is intended especially for shops where a variety of work is handled and where it is desirable to make quick adjustments for all sizes within the capacity of the machine.

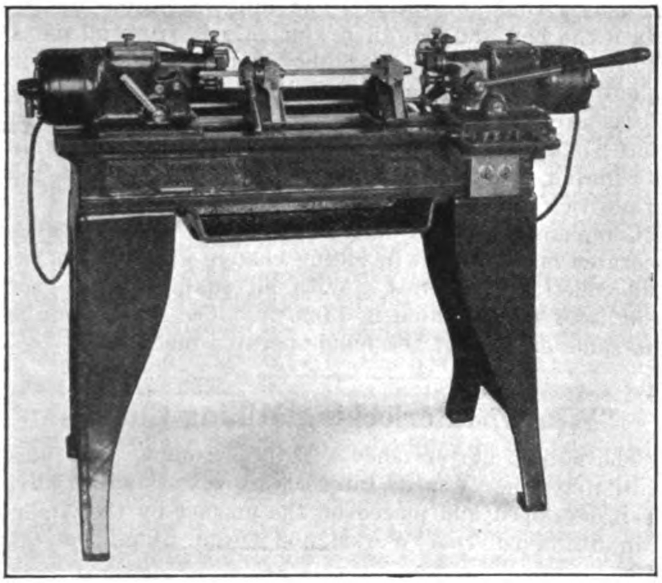


FIG. 1—PRATT & WHITNEY HAND CENTERING MACHINE

While the machine is normally equipped with opposed drill heads for centering both ends of the work in one operation, it can be supplied with only one head in case the parts to be centered are longer than the capacity of the doube-ended machine. The right-hand head is permanently attached to the bed, while the left-hand head is adjustable to suit different lengths of work, or it can be removed entirely for performing work on long pieces.

Both heads are normally operated together by the hand lever on the right-hand head. The drills are fed in by hand until they contact with both ends of the work, which is placed loosely between the jaws of the vise so that it can shift endwise. When contact is secured at both ends, both jaws of the vise are tightened at the same time by a lever operated by the left hand of the operator. The holes are then centered by further pressure applied on the lever in the right hand.

The drill spindles are mounted in sliding bronze bearings and provided with ball thrust bearings. They are each driven by a constant-speed motor, geared to provide drill speeds of either 1,200 or 1,800 r.p.m. The spindles can be locked in place for changing gears or removing drills, a small knob on the top of each head serving this purpose.

In order to hold the depth of drilling to the dimension desired, adjustable stops are provided which are mounted on the head and bear against the ends of the work to limit the forward movement of the spindles. In case it is necessary to have the center holes the same distance apart regardless of slight variations in the length of the work, adjustable stops are positioned to engage lugs on the drill heads, so that the spindles have a predetermined forward movement.

The motors are of $\frac{1}{4}$ hp. for either 110 or 220 volt alternating or direct current. They operate at 1,700 r.p.m., are totally inclosed, and in the alternating-current type are suitable for either 1, 2 or 3 phase. A switch is furnished so that the motors can be connected directly to the line.

Two quick-acting self-centering vises take all sizes of work up to 2 in. in diameter, and from 3 to 18 in. long. They are adjustable along the length of the bed, and are operated simultaneously by one lever. For heavy work up to and including 4 in. in diameter, adjustable V supports are used. Locking screws maintain the adjustments, and one of the supports has a clamp lever to hold the work in place.

After the work has been centered, it is deposited in a removable metal tote box at the rear of the machine. The oil drains from this box to the tank and is conveyed to the drills by means of a plunger pump. This pump is connected to the hand feed lever, and oil is supplied to the drills only while cutting is going on, without special attention from the operator.

Although special collets can be furnished for extra sizes of drills, two sets are normally included in the equipment. One is $\frac{11}{32}$ in. in diameter for M, L and E drills, and the other $\frac{3}{16}$ in. in diameter for A, B and C drills. For work over 5 ft. long, an outboard support can be furnished. The machine requires a floor space of 4 ft. 6 in. x 2 ft. 6 in. The net weight with the complete equipment is 600 pounds.

On the automatic machine, a front view of which is shown in Fig. 2, an automatically operated feeding mechanism working in conjunction with a magazine is employed. The work is clamped mechanically, so that after the set-up has once been made it is only necessary to keep the magazine supplied with work and take away the finished parts. The work is removed from the

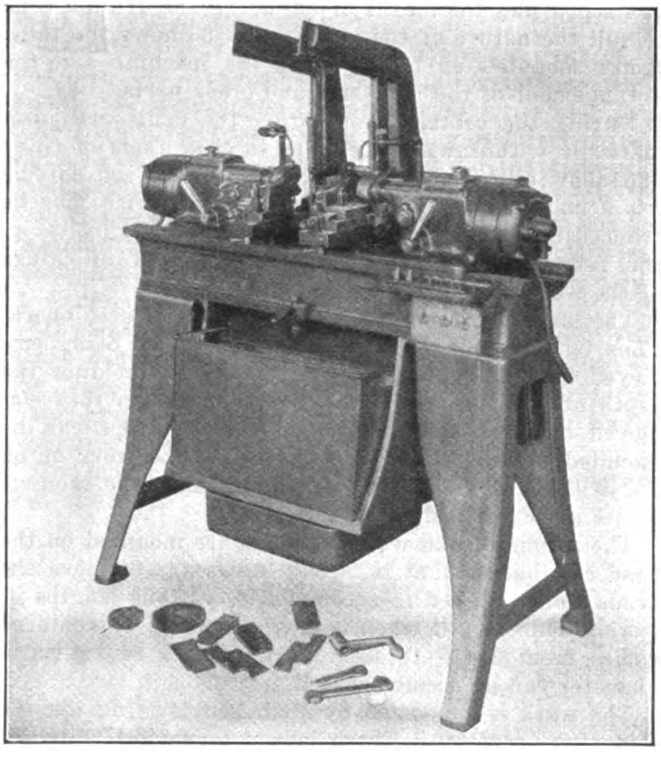


FIG. 2—PRATT & WHITNEY AUTOMATIC CENTERING MACHINE

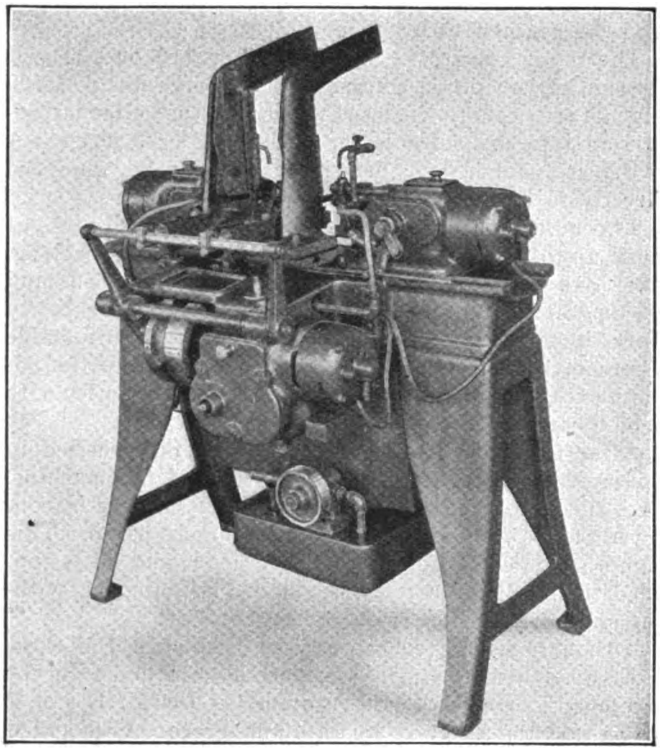


FIG. 3—REAR VIEW OF AUTOMATIC CENTERING MACHINE

magazine by transfer slides, placed in the vise, clamped, centered and then released into the work box independently of the operator.

The drill heads themselves and their driving motors are similar to those employed for the hand-operated machine. The feed of the spindles is automatic, and is operated by the same cam that operates the transfer slides. This cam is driven by a small motor similar to the motor driving the spindles, and a set of change gears provides the means of adjusting the drilling time to suit the nature of the work. Fig. 3 shows the third motor mounted on the back of the machine and the arrangement of the magazine and other parts.

During the centering operation the drills are automatically withdrawn twice so as to clear them of chips and allow oil to enter the drilled holes. Each spindle has a maximum feed movement of $\frac{7}{8}$ in. which may be reduced by a regulating lever to $\frac{7}{16}$ in., with any variation between to suit the size of the drills and the nature of the work.

The machine may be run through its cycle of operations by hand to check the set-up, a crank being employed for this purpose. The method of holding the depth of the hole uniform is very similar to that employed on the hand-operated machine. Stops can be mounted to bear either on the ends of the work or on the drill heads themselves, depending upon the requirements of the drilled holes.

The magazine and work supports are mounted on the head castings so that it is only necessary to move the heads along the bed to accommodate various lengths of work. This length when both ends are to be centered varies from $2\frac{1}{2}$ to 18 in. Work from $\frac{1}{4}$ to $1\frac{1}{2}$ in. in diameter can be accommodated.

The work is supported by V-shaped jaws during the centering operation. These jaws are provided with adjusting screws so that they may be set to any desired diameter, while an automatic compensating arrangement takes care of minor variations in the diameter of the work. The transfer plates on the slides remain in contact during the drilling and serve to clamp the work in the jaws. Different transfer plates to take care of various diameters of work can be easily mounted, and four sets of plates cover the range of the machine. By an adjustment of the V jaws, it is possible to drill holes out of center on one or both ends, such as might be wanted for driving pins used in grinding operations or for short oil holes. Facing or chamfering tools may be used in place of the drills when necessary, so that the scope of the machine can be enlarged.

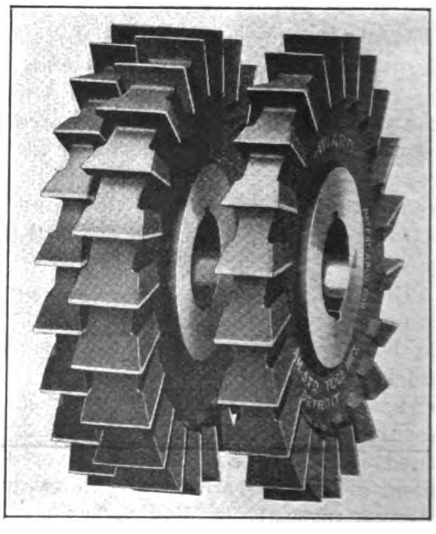
Oil is supplied to the drills by a geared pump running at a constant speed. The tank is located underneath the bed and the oil drains into it from all parts of the machine. The work box can be taken off for cleaning and for removing finished work. The work pieces are ejected directly into the box when it is in place; but when the box is removed while the machine is running, a deflector hinged on the bed can be latched in position to catch the work.

Complete equipment such as furnished with the hand-operated machine and including change gears, wrenches and collets, is supplied. With all equipment the net weight of the machine is 1,020 lb. The floor space is the same as that of the hand-operated machine.

"Wiard" Interlocking Milling Cutters

The milling cutters shown in the accompanying illustration are the "Wiard" interlocking cutters which have been developed and placed on the market by the American Standard Tool Works, 402 Owen Bldg., Detroit, Mich.

The cutters are made from drop-forged high-speed or carbon steel, and are so constructed that they can be used singly or in sets. When more than one is employed, the sides of the teeth of one cutter fit into corresponding grooves in the side of the mating cutter. Cutters can thus be ground in pairs, with the advantage that when the sides of the teeth become dull, the cutters can be changed to bring the opposite sides into play so that full wear will be obtained from every cutting edge. The chief features of the cutters are the ability to use all of the cutting edges, to employ the cutters singly or in combination interlocked with each other, and to maintain the width of the slot milled by a set of the cutters.



"WIARD" INTERLOCKING CUTTERS

Individual sections can be used as ordinary side milling cutters if desired. As the cutters become narrowed by grinding, a pair can be spread apart so as to maintain a given dimension. The cutters are made in standard sizes for diameter, and of such widths that practically any standard or special size can be obtained by using the cutters in combination.

Davenport Bevel Gear Testing Machine

A machine for subjecting to a running test spiral bevel gears and pinions of the style employed in the differentials of automobiles, has recently been placed on the market by the Davenport Machine Tool Co., Inc., Rochester, N. Y. The machine has sufficient capacity for handling all sizes of gears made for such work. Tests for determining the bearing obtained on the teeth, the quietness of running and the center distance at which the best bearing and the least noice occur, can be made on the machine.

The machine, a front view of which is shown in Fig. 1, is rigidly constructed so that accuracy is obtainable, and it incorporates a number of devices to promote rapidity of operation. There are two headstocks, one for holding the gear and the other for the pinion. The pinion is rotated by power, and a brake is incorporated to retard the speed of the gear, so that load can be applied. Both spindles are equipped with Hess-Bright ball bearings on each end, with an arrangement for keeping the oil in the bearings at a constant height.

Both of the headstocks have large bearing surfaces on the bed, and dovetail slides with taper gibs extending their entire length. Provision is made for tighty clamping the headstocks to the bed by means of bolts passing into blocks in T-slots in the bed. These bolts are close to the bearing surfaces, so that the headstocks and the bed are rigidly secured while the test is going on.

Due to the fact that there is usually but little adjustment required of the left-hand headstock on which the crown gear is mounted, this headstock is clamped down by a lever attached to one of the hold-down bolts with an adjustable connection to the second bolt, so that the bolts can be tightened equally at the same time and with one movement.

Since the right-hand headstock is moved considerably each time a pinion or gear is changed for testing, provision has been made for quickly operating it by air pressure. An air cylinder mounted on the back of the machine serves to draw back the slide a sufficient distance. The pinion or gear can then be changed and

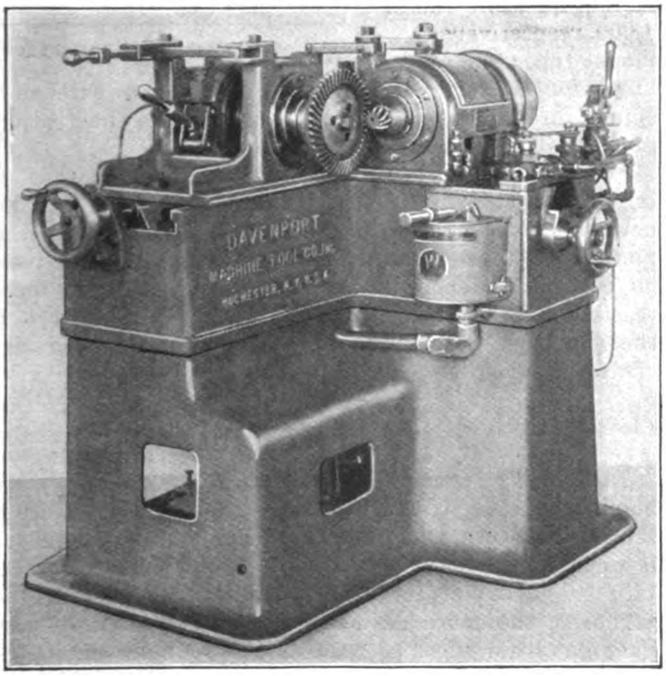


FIG. 1—DAVENPORT BEVEL GEAR TESTING MACHINE

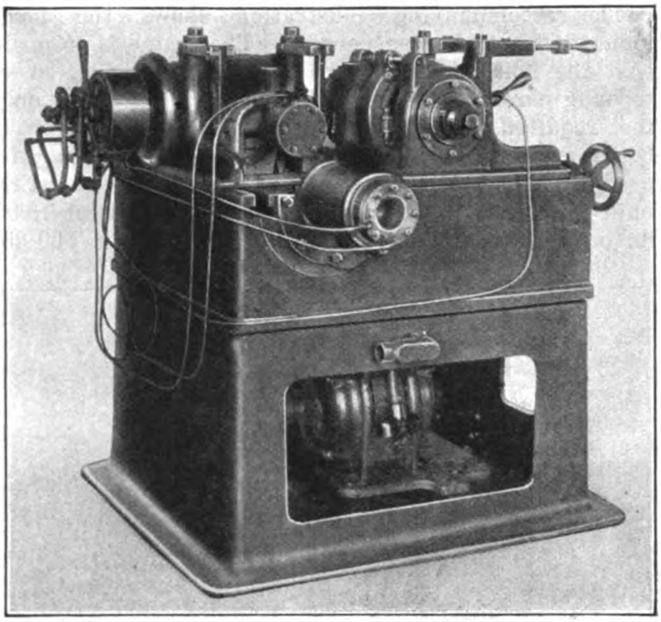


FIG. 2—REAR OF DAVENPORT GEAR TESTING MACHINE

mounted to mesh again in exactly the same position at which the last gears were tested. Other positions can be obtained, of course, as controlled by the handwheel with a graduated dial which is located underneath the right-hand headstock. Due to the fact that this headstock is moved so often, provision is made for clamping it by means of an air cylinder. An air chuck is fitted to the machine for quickly clamping the pinion.

The three valves on the front of the machine are, respectively, for clamping the work in the spindle, for moving the slide so that the pinion and the gear mesh, and for clamping the right-hand headstock. Thus moving back the slide and releasing the pinion, as well as reclamping the pinion and bringing it in place, can be very quickly accomplished.

By referring to Fig. 2, which shows the rear of the machine, the arrangement of the air cylinders can be seen. The position of the driving motor, which is of 3 hp. and driven by either alternating or direct current, can also be observed. Its position in the base permits a saving in floor space, as well as protects the motor. The motor is so mounted that the correct tension of the belt is maintained as the slide moves back and forth. It is controlled by a switch so that the spindles can be driven in either direction.

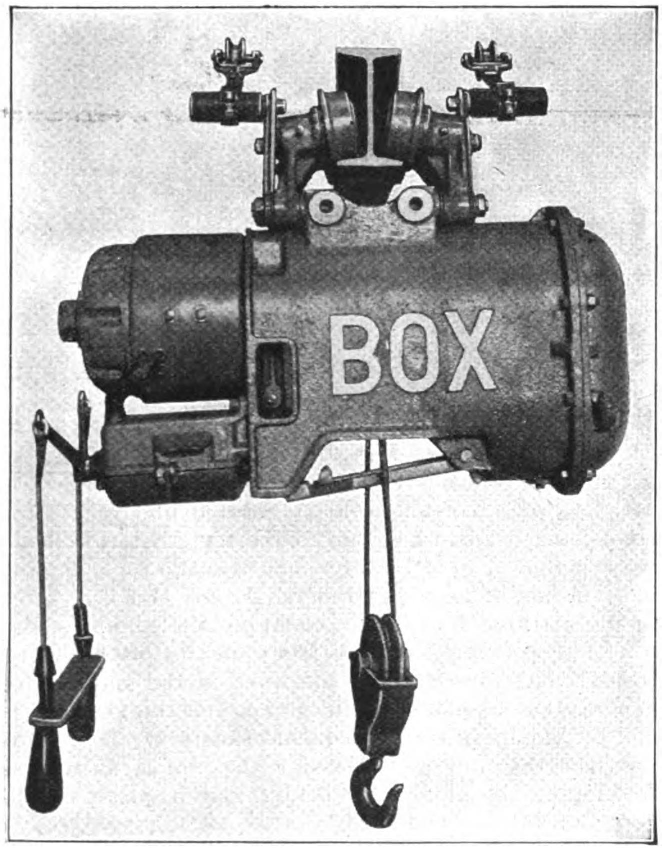
The exhaust from the air cylinders is piped to the brake band on the crown-gear headstock so as to cool the brake when a load is being absorbed. If preferred, water may be circulated through the brake for cooling purposes.

The machine occupies a floor space about 4 ft. square, and has a net weight of about 1,500 pounds.

Box "Load Lifter" Electric Hoist

A small electrically operated hoist intended for continuous service has recently been placed on the market by Alfred Box & Co., Inc., Philadelphia, Pa., under the name of "Load Lifter." Although the hoist is only 11 in. wide and 28 in. long, it is made for heavy duty such as is ordinarily encountered where continuous service is necessary and where the operator does not take the greatest care of the equipment.

The accompanying illustration shows the hoist mounted for trolley suspension. The frame is so made that the hoist may be turned through 90 deg. so as to hang parallel with the rail, a wrench being the only tool required. The trolley is adjustable to run on I-beams from 5 to 9 in. in size. Hook suspension may be used when the trolley is not required. The hoist is built in one size only and is rated to lift loads of 1,000 lb. on a two-part line at 20 ft. per min., or 500 lb.



BOX "LOAD LIFTER" ELECTRIC HOIST

on a single-part line at 40 ft. per min. The hoist has a drum which will accommodate nearly 80 ft. of rope, so that long lifts can be made even when a two-part line is employed.

The mechanism is completely enclosed, so that dirt and dust cannot get in and oil can be retained. Since the motor and controller are totally enclosed, the hoist may be installed in practically any position without danger of injury to the mechanism. Self-aligning S.K.F. bearings are used in the motor, and Hyatt flexible roller bearings at other points. All gears are forged steel and heat-treated, the teeth being of the stub type. The bearings are cast integral with the frame of the hoist, so that permanent alignment is maintained. All shafts are manganese steel.

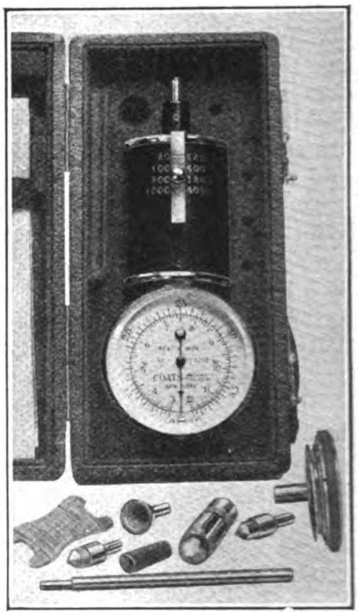
A multiple-disk load brake and a band brake on the motor shaft are both provided for holding the load in position. All parts are lubricated from one point by a combination of splash and force-feed systems. Oil must be poured into the hoist at only one point about every six months.

The controller is of the drum type and has non-arcing fingers. A terminal block is built in the controller to facilitate wiring. The hinged cover aids inspection. The controlling handles are mounted on a double lever so that they are easily accessible.

Coats Hand Tachometer

A hand tachometer recently placed on the market by the Coats Machine Tool Co., Inc., New York, N. Y., for obtaining a reading directly in revolutions per minute without watch-timing, or in circumferential feet per minute without calculation and irrespective of the pulley diameter, is shown in the accompanying illustration. The tachometer is of the pendulum or governor type and is equipped with a damping mechanism to prevent vibration and to make the instrument "dead beat." It is stated that the device is not affected by magnetic or electrical influences or by moisture or temperature changes.

The tachometer is equipped with a single spindle and arranged for either three or four ranges of speed for speeds from 30 to 1,600 r.p.m. It can be operated in either direction. A mechanically operated level is provided on the dial to indicate when the instrument is in exact horizontal alignment with the shaft to be tested. However, the tachometer may be used vertically or in any other position with equal accuracy. The device is small so that it can be easily handled, and weighs only one pound.



COATS HAND TACHOMETER

The dial is provided with two scales. The inside scale reads from 3 to 12 and the outside scale from 1 to 4. The first and third speed ranges that are marked on the body of the tachometer should be used in connection with the inside scale, and each figure should be multiplied by either 10 or 100. The second and fourth speed range works in conjunction with the outside scale, and each figure should be multiplied by 100 or 1,000, respectively. Various types of couplings for contact with the shaft and an extension spindle are provided, as can be seen in the illustration in front of the case.

For obtaining surface speeds, a "cutmeter" wheel 6 in. in circumference is employed. This wheel can be held in contact with a moving surface so that the number of lineal feet of travel per minute can be read on the dial. When the center of the shaft is inaccessible, a thread can be run over a pulley and through the groove on the cutmeter wheel to obtain the circumferential speed.

Personal Insurance

Nowadays, prominent insurance companies issue blanket policies at such low rates that, if for no other reason than to aid in keeping down the labor turnover, it would pay a management to take out policies on certain employees at its own expense. The greater the turnover, the more desirable is such action. It may have but little effect as regards the younger employees and those having no dependents, but, on the others, it is a good bond.

News Section

S.A.E. Production Meeting Widely Attended

Successful beyond expectations was the first production meeting of the Society of Automotive Engineers which was brought to a close after a two-day session in Detroit on Friday evening, Oct. 27, with a dinner at the Hotel Statler.

Interest of a national character was evident from the large gathering of executives of the automotive industry, embracing not only production but sales, administrative, service and engineering departments as well. Nearly every phase of manufacturing allied to the industry had representatives present and the consensus of opinion at the close of the sessions indicated that the meeting had been productive of a great deal of value.

Keen Interest Shown in Papers

The session of Thursday, Oct. 26, was taken up by four papers of importance. E. Karl Wennerlund discussed The Group-Bonus and Its Application, describing a system of labor and production control having advantages over the piece work, premium and flat-wage methods, in that it eliminates a large part of the complicated factory cost system.

Messrs. P. E. Haglund and I. B. Scofield described, in a paper entitled, Cylinders from the Ore to Finished Part, the methods and processes followed in Ford cylinders at the River Rouge plant. F. A. Mance of the Studebaker Corporation talked on Tool Allotment and Costs as applied to the operations in that company's operations.

New Methods of Processing Splined Shafts, was the title of a paper read by J. A. Ford in which the machining of splined shafts to precise limits without grinding received careful study and set forth valuable experience resulting from shop experiments.

The sessions of Friday, October 27, was no less interesting. A. J. Baker of the Willys-Overland Co. offered suggestions of value to production men, tool supervisors and superintendents in his paper on Selection of Machine Tools. The experiences of the Packard Co. in matters of production were related by Messrs. H. J. Crain and J. Brodie in their joint paper, Some Experience from a Production Note Book. K. L. Hermann's paper, Production Errors in Gears, bore evidence of an exhaustive investigation of gear tooth variation and its effect on gear noise. William Dunk of the Franklin organization discussed problems met in the production of air-cooled engines and R. K. Mitchell in his paper, Machine Tool Efficiency, dealt of the error of purchasing expensive special machine tools to perform operations readily accomplished on standard machines, stressing the overproduction with resultant frequent idleness of the former.

The afternoons of each day were set apart for inspection visits to the River Rouge plant, Dodge Brothers, Packard Motor Car Co., Cadillac and others. The banquet of Friday evening was presided over by Harold Emmons, with addresses by Pierre DuPont, president of the General Motors Co., A. B. C. Hardy, president of the Olds Motor Co., and Kettering Bachman.

Ethan Viall Returns to the American Machinist as Ohio Editor

Arrangements have been made whereby Ethan Viall, former editor of the American Machinist, will serve the interests of the subscribers and advertisers in the Ohio territory. Mr. Viall, who is well known to readers of the American Machinist through his ten years service on the editorial staff, has given up his business interests and settled in Cincinnati at 7474 Lower River Road, Fernbank. He will devote half his time to editorial work reserving the remainder for the completion of several technical books which have been under way for some little time.

Personnel Association Opens 1st National Convention

Industrialists, educators and personnel experts representing the country's largest business and manufacturing enterprises will engage in a three-day national forum, beginning Nov. 8, at Pittsburg, under the auspices of the National Personnel Association. Centering around the numerous discussions, addresses and committee reports, covering a wide range of administrative effort, will be the problem of "the human factor," now of outstanding importance in this and other countries.

The Pittsburgh gathering will mark the first annual convention of the Association which has taken over the activities of the National Association of Corporation Training and the Industrial Relations Association of America.

Among those who will read papers and address the sessions are: Michael Pupin, professor of electro-mechanics, Columbia University; Magnus W. Alexander, National Industrial Conference Board; H. M. Jefferson, Federal Reserve Bank of New York; Dr. E. K. Strong, Jr., Carnegie Institute of Technology; C. S. Ching of U. S. Rubber Co.; Dean R. L. Sackett of Pennsylvania State College; C. R. Dooley of personnel department, Standard Oil Co.; Dr. E. S. MacSweeney, New York Telephone Co.; Dr. R. S. Quimby, Hood Rubber Co.; Dr. F. L. Rector, National Industrial Conference Board; Paul E. Wakefield, Carnegie Steel Co;. E. K. Hall, vice president, American Telephone and Telegraph Co.; and F. L. Bishop, dean of the University of Pittsburgh.

Exporters Discuss Allied Debts at Convention

Passing resolutions endorsing the constructive policy of President Harding on the merchant marine and recommending that an international conference of business men be called together at the invitation of the U. S. Chamber of Commerce to discuss the inter-allied debt, the American Manufacturerrs Export Association brought its thirteenth annual convention to a close at the Waldorf-Astoria on Thursday evening, Oct. 26, after a two-day session.

The chief feature of the convention was the discussion of the inter-allied debt problem which took place on Wednesday evening, Oct. 25, with Sir George Paish as the chief speaker. Lewis E. Pierson, chairman of the Board of the Irving National Bank, presided and other addresses on the problem of debt cancellation or adjustment were made by George Ed. Smith, president, Royal Typewriter Co., Julius H. Barnes, president, U. S. Chamber of Commerce and Gerard Swope, president, General Electric Co.

At the banquet in the evening Alba B. Johnson of Philadelphia acted as toastmaster and addresses were made by A. C. Bedford, chairman of the board, Standard Oil Co.; Sir George Paish and Don Frederico Alfonso Pezet, Ambassador from Peru, all of whom urged settlement of debts on a reasonable and economic basis.

At the close of the business session on Wednesday, Oct. 25, Col. Myron W. Robinson was re-elected president for the ensuing year. Two new vice presidents were also elected at this session. They were W. H. Robinson of the J. H. Heinz Co., Pittsburgh, Pa., and E. P. Thomas, president of the U. S. Steel Products Co., of New York.

The morning session of Thursday, Oct. 26 was marked by a discussion of the Ship Subsidy Bill, Homer L. Ferguson president of Newport News Shipbuilding and Drydock Co., presiding. Edward C. Plummer, commissioner, U. S. Shipping Board and Hon. George W. Edmunds of Philadelphia spoke.

Meeting of Electric Steel Founders

The chief executives and the operating officials of the companies comprising the Electric Steel Founders' Research Group recently held a 3-day meeting at Wernersville, Pa., at which exhaustive progress reports were presented on researches being conducted by the organization into annealing; core practice; facing practice; furnace practice, and the elimination of slag from castings. It is stated that there has been gratifying progress in each group investigation and that the improved volume of business in the industry at present affords better opportunity for the prosecution of certain researches than when operations were curtailed during 1921.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

THE Secretary of Agriculture, Mr. Wallace, delivered an address last week in which he was very emphatic in demanding lower freight rates for farm products. As it is unlikely that the Secretary of Agriculture would have spoken so forcibly without the approval of the President, his speech is perhaps the most important news of the week in its relation to domestic affairs.

The appeal for lower rates voiced by Mr. Wallace came just as the Pennsylvania, the Norfolk & Western and some other railroads announced the resumption of pre-war dividends, and since cheaper transportation for goods and passengers is not consistent with increased dividends unless the costs of operation can be reduced by consolidation it is not surprising that the railroad combinations for which the Esch-Cummins bill provides are again being seriously discussed. The old plan under which the Northern Pacific, the Great Northern and the Burlington would be operated as one system is again being discussed, it is reported that the New York Central will take over the Western Maryland, and many other amalgamations are being suggested.

As they take shape it will probably be discovered that many railway securities now selling at big discounts have a value hitherto unrealized. This explains the relative firmness of railway shares in the securities markets, which have been otherwise spotted as a somewhat lower range of values for both bonds and stocks.

The Liberty issues have continued to reflect the hardening of the money market and even Secretary Mellon's new 4¼s are below the issue price. Taxable bonds have of course taken their cue from Government securities. They, too, are cheaper. The automobile stocks are distinctly lower, chiefly as a result of the Ford cut in prices, and the rest of the list has been rather droopy despite the continued declaration of stock dividends by some of the oil companies and the flagellation of the market by those who have hoped that a simulation of activity would reattract speculation.

Commodities, on the other hand, have been firm and in many important staples an advance over last week's prices has been recorded. Cotton and cotton goods have been conspicuously strong. So have wool and woolen goods. Rubber has held most of the advance recently recorded. The tendency in the cereal markets is still upward. Coffee, tea and rice have been relatively firm. Old crop sugar has again advanced. A statistical scarcity until the new crop is available is indicated, as the unsold stocks in Cuba have dwindled to only 75,000 tons.

Among the metals copper is the only laggard. Iron, steel, zinc and tin are all in good demand at full prices. It may be that some of the staple commodities are nearing a price level at which consumption will be checked, but this is doubtful for optimism is general and in the cities at least there is no unemployment. Good wages are to be had by all those who are willing to work.

The theory of gold inflation to which I have previously referred is becoming generally accepted as explaining the contrasting strength of the commodity markets and the weakness of the security markets. The latest authority of distinction to accept this theory is the Harvard Committee on Economic Research. Its chairman predicts steady and advancing prices for the next decade because an annual increase of $150,000,000 in the world's stock of monetary gold for the next eight years is indicated. Sir George Paish of London who is over here on a lecture tour is talking in the same strain and many conservative merchants and financiers who were formerly disposed to "pooh pooh" what they called the college professor's view of economic questions are now coming to realize that the purchasing power of gold as expressed in other commodities is declining and will probably continue to decline as long as the United States remains the only important country in the world using the gold standard and thereby attracting hither most of the new gold produced.

> The outstanding problem of the moment before American business men is that of the inter-allied debts. It is idle to suppose that our present prosperity can long continue if the countries abroad cannot buy the great quantities of American agricultural products which they have purchased in the past and of which they stand in need at present. And buy they cannot, if they are unable to sell their own produce.

To say that the purchasing power of gold is declining is but another way of saying that the value of commodities as expressed in terms of gold must advance and that the prices of securities must decline, for the value of the latter is only that of gold.

Premising the correctness of this theory a further advance in commodities and a decline in securities, especially bonds, seem to be indicated. But it is not to be expected that any of the markets will progress continuously in one direction. Reactions will occur from time to time and for such reactions intelligent business men should prepare themselves. No rule that will be universally applicable can be formulated and common sense, assisted by close observation, must still be used in navigating the uncharted channels of business.

When everyone has accepted the theory of gold inflation it will probably be found that its effect has been discounted.

My reports from abroad are that the use of the American dollar as an unofficial medium of exchange is increasing throughout continental Europe, and the decline in francs, lira and other continental currencies is attributed chiefly to the eagerness to exchange worthless paper money for a currency of integrity that is payable in gold.

Chancellor Wirth's proposal that the German government should declare itself bankrupt has caused some consternation among the thoughtless, but with marks selling at 2¼ cents a hundred the bankruptcy of Germany would seem to have been unofficially confessed and it is to be remembered that the bankruptcy of a Government does not necessarily imply the bankruptcy of its people. The truth of this observation is attested by the reports of improved business in Europe now being received.

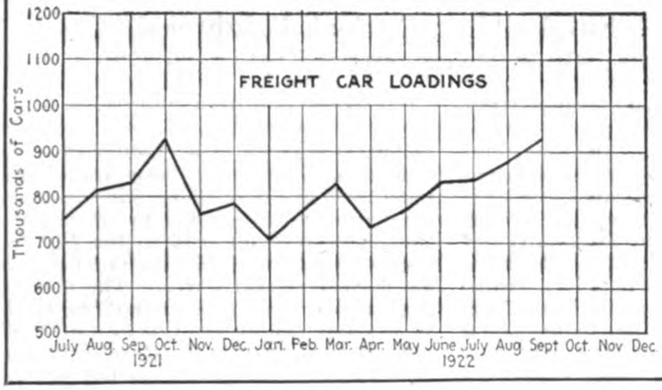
At a meeting of the American Manufacturers' Export Association, Dr. Julius Klein, a Government expert. expressed himself most optimistically in regard to conditions in Europe and a friend of mine who is a large dealer in naval stores told me that he had sold 5,000 barrels of rosin to Russia last week, being paid in dollars.

The weekly statistics are not especially significant. The reserve ratio of the Federal Reserve System shows a gain of 2.4 per cent. It now stands at 77.6 as compared with 75.2 a week ago. The improvement is probably due to the liquidation of credit incident to the distribution of the Government bonds recently brought out. The gold held shows a reduction of nearly $2,000,000, which probably reflects the continued disbursement of gold certificates or "yellow backs" by the banks.

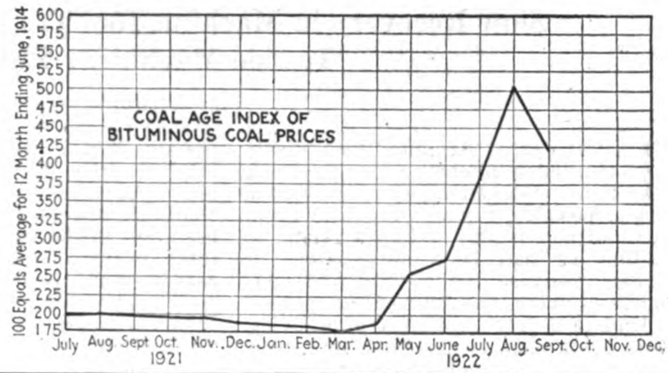
The correspondence between Representative Frear and Secretary Mellon in regard to the stock dividends recently declared by the Standard Oil companies may foreshadow some legislation that will be designed to make stock dividends taxable.

President Harding's advocacy of a change in the law or an amendment to the Constitution that will close the door to tax exemption and restrict the issue of tax-exempt securities is another evidence of the disposition to widen the incidence of the income tax law that should not be ignored. It may have a very important effect upon the entire security market. Generally speaking, however, there seems every reason to expect a continuance of commercial activity during the winter.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association.



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base.



FREIGHT CAR LOADINGS, which began an upward movement in June have continued to mount rapidly upward during September. For the weekly period ending Sept. 2, a total of 931,598 cars were loaded. On Sept. 30, 998,381 cars were reported, the average for the month being 936,386, as against the August average of 887,000. Coal, grain and merchandise loadings continue heavy, with increases in each, and a serious car shortage has developed, reaching 156,309 cars on October 14.

Bituminous coal prices, as indicated by *Coal Age* index, continued their downward movement during September, the average for the month being 412 as against 507 in August, with spot prices for the same periods standing at $5.08 and $6.14 respectively. The month has shown no active demand, buyers being disposed to postpone placement of requirements in the face of declining prices.

Automobile production for September shows a marked seasonal decline from August output, 186,562 passenger cars and 18,843 trucks being turned out as against 249,225 and 24,200 respectively in the previous month. The September total of 205,405 is the lowest since March of the current year but well above the output for the corresponding month of last year in which a total of 178,317 cars and trucks were produced.

Share markets continued their upward movement during September, although the advance was not quite so marked as in July and August. The average of 50 stocks, 25 rails and 25 industrials moved up to 87.85 as against 86.66 in August. The high point during the month was reached during the week ending Sept. 9, on which date the average was 89.47. The critical situation which developed in the Near East weakened the market in the latter part of the month but with a passing of this cloud there has come a recovery. Earnings of high grade rails and industrials continue excellent and regular dividends seem indicated for a considerable period.

Skilled metal workers are scarce and rates are high. In the New York district tool makers are being paid 75, bench hands and lathe hands 60 cents per hour. Philadelphia reports a range of rates which is wider and somewhat higher, toolmakers receiving from 60 to 90, bench hands 50 to 85 and lathe operators 50 to 90. The Detroit district range for toolmakers is between 75 and 80, bench hands 50 to 55 and lathe operators 70 to 75 cents per hour. Cleveland reports show toolmakers' rates ranging between 50 and 75, bench hands between 40 and 60 and lathe operators between 35 and 65.

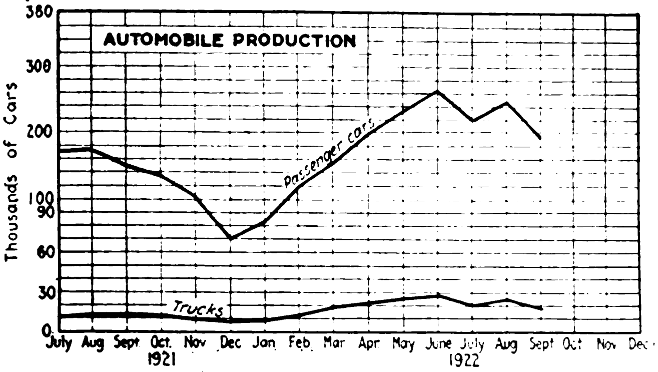
Iron castings per pound, based on prices quoted to *American Machinist*, Oct. 27, for 100 flywheels, each of 275 pounds weight and of plain pattern show an average of about 4.9 cents for four cities. New York was highest with 7 cents, and Cleveland lowest with a quotation of 2.4 cents, Chicago and Detroit coming in between, the former quoting a range of 4 to 5 cents and the latter a price of 6 cents per pound.

Comparative Prices of Shop Supplies

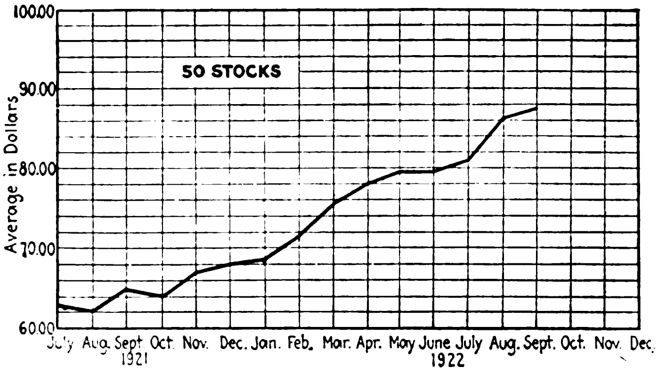
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.	$0.0295	$0.0285	$0.0273
Cold finished shafting......	per lb.	0.0378	0.0373	0.0379
Brass rods......	per lb.	0.171	0.1700	0.148
Solder (½ and ½)	per lb.	0.23	0.228	0.20
Cotton waste..	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.575	0.575	....
Machine oil....	per gal.	0.36	0.36	....
Belting, leather, medium......	off list	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Average for 1919, 138,138 cars; 26,364 trucks.



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week.



Business Conditions in England

Slow Recovery in Machine Tool Trade—Shipbuilding Outlook Brighter—Textile Machinery Builders Show Prosperity

By OUR LONDON CORRESPONDENT

THE early Autumn has disappointed a number of engineering firms who had expected something better, possibly because the late Summer had not proved so bad a friend to trading as had been anticipated, or perhaps because the Fall of the year and the Spring are commonly supposed to lead to a fresh outburst of activity. Once again enquiries became numerous in the machine tool trade and many firms are again living on hopes.

The small tool trade, if not of normal dimensions, is still not without bulk, though it is to be feared that in some instances the prices obtained have not been remunerative. Everyone is asking, not for the first time, when the machine tool industry will recover, and as this industry has truthfully been described as the handmaid of the rest, it may be well to try to estimate the immediate future of the various branches of the engineering industry generally.

Price and Wage Trend Uncertain

It is fairly evident that some few people are waiting to make sure that prices have really reached a minimum. Whether this is the case in any particular instance depends more largely than usual, because of the restricted demand, on the costs, which certainly show a tendency to decline but not to the extent of other factors that make up price. For instance, apart from national taxation, local rates form a heavy burden on industry and usually do not yet approximate to the decline in prices already manifest. There are makers of machine tools who declare that any change in prices will have to be in an upward direction, if business is to be profitable.

As to engineering wages, few employers will willingly attempt further lowering. The third cut has been made, so that within the last two months or so the weekly rates have dropped by 16s. 6d. It is true that on the shipbuilding side, where the new work commenced during the first half of the year was less than 90,000 tons, a movement has been made for a further reduction of 10s. a week—thus removing the whole of the war bonus. On the other hand, engineering workpeople engaged on textile machinery production have applied for an advance of £1 a week. This, it may be mentioned, is somewhat against the general policy pursued by the chief engineering trade union, who desire wages to move steadily over the whole industry and not to be controlled section by section. Then, again, the view is held that prices of materials have declined to the limit of the present and the immediate future and that should there be any improvement in demand the effect must be an increase of price. Consequently, at any rate in machine tools, the best value likely for some time is now available for the purchaser.

From what has been said in these columns it will be gathered that the textile machinery side of engineering remains in a prosperous condition. This has been true for two or three years, but it is highly improbable that the enquirer will now be met, as he has been met in the past, by a quotation of three years' delivery. It would seem rather that the export orders which have kept this section of engineering in such a happy condition are being worked up; on the other hand, it is with confidence anticipated that the home demand will improve.

It is a fact that from the manufacturer to the repairer of textile machines and details a state of full activity prevails, and even a well-known firm of chain makers has to some extent entered the field. Some indication of the position is given in the report, recently issued, of Dobson & Barlow, Ltd., Bolton, the profit declared for the year 1921-1922, amounting to £266,512, as against £93,626 for the twelve months previous and £91,253 the year before that. The latest dividend is at the rate of 30 per cent and £135,000 is carried to reserve, which amounts to £300,000, the issued ordinary capital being £200,000.

> British industry has been passing through the most severe depression ever recorded in its history. Depending almost entirely upon its overseas trade, the world depression has affected its industrial and economic life in a manner which is difficult to estimate. Here and there bright spots are beginning to appear and a settlement of the question of interallied debts will do much to establish equilibrium and place the nation once more in the front rank of America's customers abroad.

Electrical Firms Show Improvement

Probably electrical engineers are in the next position of prosperity, though it will not have escaped notice that the Coventry works of the English Electric Co., are closing down, leading to the discharge of some 800 men. Until the last few years this particular works has been engaged on the production of ordnance and certain small tools, and when the combination of electrical firms named was effected it was understood that the main purpose of these shops was to undertake heavy machining for the works in other parts of the country. Still, in the electrical industry a considerable scope remains in connection with power houses and traction, and if prices can be adjusted the prospects cannot fairly be described as unpromising.

In shipbuilding the outlook is brighter than it has been. A few orders have recently been placed on the Clyde and elsewhere but it is understood that they have in several instances been contingent on the further wages reduction. Ship-repairing has not been in so bad a case. The marine engineering branch is almost as slack as any other, and the directors of Parsons Marine Steam Turbine Co., for example, report great difficulty in obtaining orders for marine turbine installations; they show profits of £34,198 against £42,581 in the preceding 12 months. The indications of improvement in agricultural engineering are not specially marked.

In the automobile world the dead season is of course being entered. Much, some people think too much, is being hoped from the very definite price reductions, not only of motors themselves but also of such details as tires, petrol, etc., and the general tendency is shown by the introduction of a 20 hp. Rolls-Royce car to take its place alongside the higher-power vehicle.

Seasonal Decline in Autos

A Coventry firm recently paid 40 per cent, but losses continue to be reported. The Vulcan Motor & Engineering Co., a Southport section of the Harper-Bean combination, for example, followed the payment of 30 per cent free of income tax for five successive years with a loss of £434,261 in 1920 and one of £421,205 in 1921: the total loss however is reduced by excess profits duty remitted and reserves written back to the total of £454,560. The report of the Star Co., Wolverhampton, shows a loss of £58,453—ascribed to the abnormal conditions of trade and depreciation of stock—so that once again no dividend is paid. The Ford Co., it is understood, have acquired land near Southampton, where, it is stated, the buildings will cover about 20 acres, the output being 200 cars a day as against 160 at Trafford Park now. Southampton is, in fact, to become the distributing centre not only for Great Britain but also for Europe. The commercial vehicle side is clearly in a depressed condition and, as in the case of pleasure cars, to a marked degree debentures and similar papers have necessarily been taken as payment by suppliers of material.

To take another large market for the machine tool industry, the railways have for some time stopped buying. But it is generally thought that this arises from caution and not from faliure to recognize the need for further and more modern plant in the form of machine tools. Our numerous small lines must in the course of little more than a year sort themselves out according to plan into four large amalgamations, divided mainly geographically. The process is under way and in several instances has made rapid progress. It is anticipated with some confidence that as soon as the amalgamations are completed, and the engineers of the various lines know exactly the position, the machine tool trade will

be called on. The amalgamations are of course to be effected in view of economy, and it is quite possible that some of the small shops, and even the larger works, belonging to the different lines will find their occupations gone. On the other hand, the need for improved methods of machining is quite well recognized, and it is in this direction that the machine tool man will turn most hopefully in surveying the future. But any demand is hardly likely to show itself for some months. Railway rolling stock builders are reporting increased profits. Hurst, Nelson & Co., Motherwell, show a profit of £106,575 as against £94,230, and Kerr, Stuart & Co., Ltd., indicate net profits at £62,824.

For the present the radio industry languishes. Two exhibitions have been held in London, one almost on the heels of the other, and they have been well attended, particularly by schoolboys and youths. But broadcasting arrangements are incomplete, and the license fees to be paid to the postmaster-general are not yet settled.

TOOL BUILDERS ENTER NEW FIELDS

The machine tool industry remains very poorly occupied and the possibility is that, provided satisfactory arrangements can be made as regards the building, the next exhibition to be organized by the Machine Tool Trades Association will be held in 1925 rather than 1924. Two or three relatively small firms can be mentioned as being fairly well engaged; they are concerned with special tools for textile machinery makers. As for many months past, makers of standard tools in quantities are the firms least likely to receive orders. Little that is definite is available regarding the financial position. One firm, at any rate, after about paying its way for the two previous years, according to its latest report made a loss during the past 12 months of some £6,000 on trading transactions totalling about £55,000. The individual members of the machine tool industry, in fact, have had to look in other directions for business and have turned their hands of late—to mention some instances—to the production of small engines for agricultural purposes, to printing machinery and to cleaning appliances for tennis balls. Armstrong, Whitworth & Co., Ltd., are now manufacturing road rollers, steam- and oil-driven, and other road-making machinery, the Openshaw works thus again taking up a branch of engineering initiated there nearly 70 years ago by Joseph Whitworth, who built a road sweeper on the conveyor and hopper principle.

As it has been stated, the weekly wages rates of engineering workmen have been reduced by 16s. 6d., and employers and employed have been in conference over systems of payment by results, but without agreement, that is without agreement as regards the ordinary machine shop. Certain of the trade unions of foundry workers and pattern makers have accepted the proposals of the employers, who have now intimated to the other engineering work people that they consider themselves free to introduce such systems as they find necessary. They agreed at the termination of the last dispute not to introduce anything of the kind for at least one month. This of course applied to proposed new schemes, as piecework in certain districts is exceedingly common.

A joint investigation committee of employers and trade union representatives indeed has been considering the whole subject, having, according to a preliminary statement, inspected in detail 32 engineering and shipbuilding organizations in the United Kingdom, 11 in Belgium, 4 in Germany and 7 in Holland, and it is understood that the advisability is being considered of visiting America for the same purpose. An agreed statement of a private character has been drawn up, but some at least of the details have been made public, from which it is gathered, in comparing outputs on time and piece work rates, that the fitting of certain water-tight shutters took 490 hours in one case on time rates and 150 hours when the pay was by results. Similarly a ship built on time rates took 2,601 hours, while a similar ship on the payment-by-results system was finished in 1,151 hours. Riveters on time dealt with 176 rivets as against 722 rivets on piece, and so on. Individual rather than collective systems of payment by results seem to have proved the better. The investigation arose out of the demand about three years ago for a 44-hour week, now seemingly forgotten.

The figures issued of national revenue and expenditure suggest that the Budget forecast can be borne out, provided of Course Great Britain keeps clear of war. For the first six months the revenue amounted to nearly 404 million pounds, the total decrease being lower than was estimated. In the same period the expenditure was rather less than 347¼ million pounds, proportionally a still larger decrease, the revenue thus showing a surplus over expenditure of nearly 56¼ million pounds. Without going into details it may be said that the revenue figures suggest the complete breakdown of the excess profits duty, less than a million pounds having been received on this account out of a total of nearly 28 millions which, it was estimated, would be received for the complete fiscal year. Officially reported unemployment continues to decline somewhat, while the cost of living shows a slight decrease.

Hoffmann Bearings to Be Made in America

The Norma Company of America, Anable Avenue, Long Island City, N. Y., has acquired the American patents and business of the Hoffman Manufacturing Co. of Chelmsford, Essex, England, makers of "Hoffmann" roller, ball and thrust bearings. The line of "Norma" Precision Ball Bearings will now be supplemented with "Hoffmann" Precision Roller Bearings.

The "Hoffmann" Roller Bearing has long held, abroad, the same repute which high-precision standards have given the "Norma" Ball Bearing in America. For the past year the Norma Company has thoroughly investigated the American market for roller bearings of this high quality, and has found a distinct demand for high-grade units.

The Norma Company will erect a a new plant for the manufacture of "Hoffmann" products in America. Meantime, they are being imported and sold under the regular "Norma" engineering service.

Ryerson Celebrates 80th Anniversary

Eighty years ago, on the first day of November, there arrived in Chicago from Pittsburg, Joseph T. Ryerson, the accredited agent of Wood, Edwards and McKnight. It was during that period in America's economic development known as the fifth stage, the period in which a great westward movement of population took place.

The population of the then gateway to the west was about 6,000 with a few buildings of brick and more of a rude frame structure, nearly all ranged along the water front.

Here in 1842 Joseph T. Ryerson laid his foundation. He rented a little store and started in the iron business with a small stock from Pittsburg. The steady westward movement and the ever increasing population of Chicago compelled him, two years later, to buy land and build a two story structure on Lake Street. By 1852 the location, due to the spread of the dry goods district, became unsuited to the iron business. A site was purchased on South Water Street on the river. Here, until the great fire in 1871 reduced it to ashes, the business grew and prospered. By March, 1872, one year later, it had been rebuilt on Clinton Street and business was again under way. Ten years later the premises was again enlarged, and when, in 1883, Mr. Ryerson died, the administrative direction of the business, already grown to no mean size and now known as Joseph T. Ryerson & Son, fell upon the shoulders of his son, Edward L.

Steadily through depressions and panics it has grown until today the small frontier iron store, started in 1842, occupies a ground area of 19 acres in Chicago alone. Linked to this central point in the system have been added the plant of the W. G. Hagar Iron Co., St. Louis, Mo.; a warehouse in New York, a plant in Detroit completed just prior to America's entrance into the war and the warehouse of the Ferguson Steel and Iron Co., Buffalo, purchased in 1919.

The business stands today as a happy outgrowth and a monument befitting the restless energy so characteristic of America's early pioneers. The celebration of its 80th anniversary, coming as it does on the threshold of a new era of sound prosperity, is an event of which the company's executives may well feel proud.

Engineers Discuss Management

Management in all its various phases was discussed by managers of national reputation at the two "Management Week" meetings held at the Auditorium Hotel in Chicago, Oct. 18 and 20. The following papers were presented: Application of Scientific Management, by A. M. Simon, American School of Correspondence; Management and the Human Factor, by John Calder, Supt. of Industrial Relations, Swift & Co.; Personal Aspect of Management, by Hugo Diemer, LaSalle Extension University, and What Is Management Control, by W. H. Leffingwell, Pres., Leffingwell Ream Co., Management Engineers, New York City.

Organization Changes of the Dodge Manufacturing Corporation

Among the changes that have recently taken place in the organization of the Dodge Manufacturing Corporation, Mishawaka, Ind., we note the following:

President, Melville W. Mix; vice-president, W. B. Hosford, treasurer, Charles Endlich; assistant treasurer, W. L. Chandler; foundry superintendent, Harry Bell and Mr. Mix's son, publicity manager, have retired.

It is understood that Mr. Mix sold his interest for $1,500,000 and that Messrs. Hosford and Bell have been given life pensions.

Charles F. Morse, a well known corporation attorney of Chicago and Mayor William W. Dodge, of Mishawaka, holder of the controlling interest in the company, have been elected president and vice-president, respectively.

Business Items

The Dover Machine Co., Pawtucket, R. I., manufacturer of machinery, etc., during the past week changed the name of the concern to the Henry A. Goodrich Co., and have moved the plant to East Providence, R. I., where they will be better equipped.

Peters & Russell, Inc., of Boston, Mass., has been incorporated and organized under the laws of Massachusetts, to deal in all kinds of buffing and polishing wheels, machinery, etc. The capital stock is $50,000, and the officers chosen are: Paul A. Peters, president; Frank H. Russell, 75 Park St., West Roxbury, Mass., treasurer; and Donald L. Whittemore, director.

The American Pipe Tool Co., 123 South Jefferson St., Chicago, is the name of a new concern recently organized by W. H. Gabel, formerly general manager of the Crown Die and Tool Co. of that city. The company will engage in the manufacture of a line of pipe tools and is introducing at the present time the "American" portable pipe vise stand.

The American Adjustable Chase Co., Inc., 43 Water St., Torrington, Conn., was incorporated and organized during the past week under the laws of Connecticut, to engage in the general manufacturing business. The capital stock of the company is $75,000, and the incorporators are: Daniel F., William A. and John H. Burns. Daniel F. Burns has been chosen president; John H. Burns, secretary, and William A. Burns, treasurer.

The Gulf States Steel Company for the quarter ended Sept. 30, 1922, reports net operating income of $340,287. Net income, after taxes, depreciation and other charges, amounted to $252,284.

The Consolidated Tool Works, Inc., 266 Broadway, New York City, announces the following appointments in its sales personnel: Wm. H. Thompson, formerly with the Union Hardware Co., Torrington, Conn., will be its representative in New York City; Charles Alburtus, formerly with the American Safety Razor Co., Brooklyn, N. Y., will represent it in New Jersey; Howard A. Postley, formerly with the Knickerbocker Manufacturing Co., Belleville, N. J., is appointed to represent it in the New England States, and Wm. L. Rubin, formerly with the Jacobs Scale Co., New York City, is appointed its representative in New York, Pennsylvania, Maryland, District of Columbia, and parts of West Virginia and Ohio.

The Bethel-Player Co., Westboro, Mass., has been formed for the purpose of marketing the Fraser automatic grinder, tapping machines and metal products. Mr. S. Player was formerly production manager of the Taft-Pierce Manufacturing Co., and later general manager of Warren F. Fraser Co. J. N. Bethel was also long associated with the Taft-Pierce Co. and sales manager of the Warren F. Fraser Co.

The Packard Motor Car Co. reports September earnings amounting to $900,000 with $16,000,000 cash and marketable securities on hand.

The Lima Locomotive Works directors have declared a dividend of $1 a share quarterly on the new common stock without par value, thus placing the stock on a $4 annual dividend basis.

The Precision and Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa., is now under the direction of A. T. Doud, president of the company, who purchased the capital stock formerly held by members of the Hudson Motors Specialty Co. of Philadelphia. The two companies are no longer affiliated. Mr. Doud has been in charge of the Precision and Thread Grinder Manufacturing Co. since the early part of July, 1922, but the deal was not consummated until the latter part of September.

The Seaboard Air Line Railway Co. has been granted authority to issue $2,560,000 of equipment trust certificates, the proceeds to be used to purchase three freight locomotives, 1,250 wooden boxcars, 900 steel underframe boxcars, 850 underframe drop bottom gondola cars, and 100 all-steel phosphate cars.

G. E. Osborne of Wichita, Kan., will open a machine shop at 433 Wabash Ave., in that city Nov. 1, where he will conduct a general machine shop business and install modern machinery.

The Biltwell Factories, Wichita, Kan., has taken over the Western Furniture and Manufacturing Co., located at 1414 S. Washington Ave., in that city and will install various new machinery and machine tools. C. W. Rogers is manager.

The National Enameling and Stamping Co. has broken ground at Granite City, Mo., for its new $1,500,000 plant. The plant will contain six sheet mills and one jobbing mill.

The Rudolph Jiffy Tool Co., Eau Claire, Wis., is the name of a new company recently incorporated in that city to manufacture a line of mechanics' tools and auto specialties.

Alvord Reamer and Tool Co., Millersburg, Pa., announces the appointment of C. C. Strout in the capacity of vice-president, in charge of sales. Mr. Strout was formerly connected with the Victor Saw Works, as Western Sales Manager, and with the Safety Wrench and Appliance Co., as general sales manager. This company also announces the formation of a service department in connection with their engineering department, under the direction of A. M. Lindsley, chief engineer, which will function by supplying consulting service in connection with special tool equipment.

The Allis-Chalmers Manufacturing Company reports net profits after Federal taxes for the quarter ending June 30 of $299,796.

The Burdick-Atkinson Corporation is the name of a new concern recently established at Hamburg, N. Y., to manufacture wire springs for use in automobile upholstery. John S. Burdick, the incorporator, is president and general manager and associated with him are Frederic R. Atkinson, vice-president; Franklin R. Brown, treasurer and Harry Burdick, secretary.

The White Motor Co. is reported to be planning the establishment of a branch factory at Chattanooga for the manufacture of trucks.

The Western Specialty Manufacturing Co., capitalized at $32,000, filed articles of incorporation in Vancouver, Wash., recently. The company will manufacture automatic lock-nuts. The incorporators are C. F. Kletsch, C. R. Catlin and B. E. Hawley, all of Kelso. The principal place of business of the firm will be at Vancouver.

The American Machine and Foundry Co. directors have declared a stock dividend of 200 per cent, payable Nov. 15, to stock of record Oct. 19.

The Trexler Co. of America, manufacturer of auto accessories, has taken over the Wilmington plant of the Artillery Fuse and Standard Arms Co.

The Decker Manufacturing Co., Brockport, N. Y., manufacturer of power spray outfits, has been sold to E. H. Norton, who has been associated with the company as salesman. Mr. Norton will continue the business.

The Hartford Tap and Gage Co., Hartford, Conn., has changed its name to Hanson Tap and Gage Co.

The Dolman Manufacturing Co., is the name of a new corporation recently incorporated at Springfield, Mass., to manufacture a line of small tools, the first of which, the Dolman screw driver, has recently been placed on the market. The organizers are Guy W. Donahue, William F. Pollock and Chester C. Jackman, all formerly associated with the Victor Saw Works, Inc., Middletown, N. Y.

Personals

PETER PARKE, chief engineer of the Pullman Co., has been transferred to the department on improvements and economy covering investigations into modern methods and machinery.

E. W. TEST of the Michigan city plant of the Pullman Co. has taken over the duties of Peter Parke with the title of general mechanical engineer.

EDWARD T. PETERSON, formerly of the organization of the Treadwell Engineering Co. has been appointed chief engineer of the Birdsboro Steel Foundry and Machine Co. Birdsboro, Pa.

MAYOR ALBERT PETER, until recently with the Chain Belt Co., Milwaukee. has been appointed chief engineer and works manager of the Milwaukee Air Power Pump Co.

E. W. SMITH has been appointed general superintendent of motive power of

the Southwestern region of the Pennsylvania Railroad with headquarters at St. Louis, Mo.

H. H. COLBUS has joined the sales staff of the Down Tool Works, Inc., Fleetwood, Pa., and will represent the company in the Philadelphia district.

G. C. BAUMAN, formerly with the Rich Tool Co., Chicago, has accepted a position as superintendent of the Ward Tool and Forging Co., Latrobe, Pa.

JOHN E. SNYDER of J. E. Snyder and Son, Worcester, Mass., vertical drilling machine builders, returned recently from a trip to England and the continent.

NELSON C. JOHNSON, secretary of the Foster, Merriam & Co., manufacturer of hardware, etc., Meriden, Conn., has recently been chosen the treasurer of the company also. Mr. Johnson succeeds John A. Ross, who resigned his position as treasurer during the past week.

CHARLES C. RAMSDELL, vice-president of the Gilbert & Barker Manufacturing Co., West Springfield, Mass., was recently presented with a 30-years' Service Pin in honor of his thirty years of service in the Gilbert & Barker organization. Mr. Ramsdell entered the employ of the firm in August, 1892, and has worked his way up from New York salesman to the present position.

R. I. CASE, until recently associated with Eccles & Smith Co., San Francisco, machinery dealers, has been appointed manager of the machinery department of the Berger & Carter Co.

CHARLES E. STAHL, vice-president, assistant general manager and sales manager of the Connecticut Telephone and Electric Co., manufacturer of telephones, systems, tools and electrical goods, etc., of Meriden, Conn., during the past week resigned his positions with the company. Mr. Stahl has been with the firm for the past ten years.

HENRY A. TREMAINE has been elected president and general manager of the Grant-Lees Co., manufacturer of motor car and truck transmissions.

REGINALD W. MILLARD, president of the Foster, Merriam & Co., manufacturer of hardware, etc., Meriden, Conn., has recently resigned his position with the company. Mr. Millard is succeeded by Howard E. Boardman of New York City as president, Mr. Boardman having been chosen at a directors' meeting held during the past week.

F. E. BOOTH has been appointed sales manager of the motor bearings division of the Hyatt Motor Bearing Co.

VAL A. BROWNING, son of John M. Browning, inventor of the machine gun bearing his name, arrived in this country recently from Belgium where he is consulting expert for the Fabrique Nationale, Heerstal, Belgium, and will pay his father a visit in Hartford, Conn.

R. H. BECKER, formerly connected with the machine tool building and sales department of Joseph T. Ryerson and Son, is now with the Milwaukee Machinery Co., 93 West Water St., Milwaukee, Wis. He will have charge of machine tool sales in part of the Milwaukee and southern Wisconsin territory.

Obituary

A. J. BEATON of the Beaton & Cadwell Manufacturing Co., manufacturer of metal novelties, air valves, etc., died at Norwood, Mass., Oct. 21, at the age of 74 years. Mr. Beaton was also at one time connected with the A. J. Beaton Co., and the Beaton & Corbin Co., both of New Britain.

CHARLES GLOVER, president, the Skinner Chuck Co., New Britain, Conn., and one of the best known manufacturers of screws in the country, died at his home in New Britain Oct. 25 after a long illness. Mr. Glover was 75 years old and was prominent in industrial circles throughout the eastern states. He was a former president of the Corbin Screw Corporation, a director of the American Hardware Association and a director of the New Britain National Bank.

Book Reviews

Statistical Abstract of the United States for 1921. Compiled by Edward Whitney. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C. Price 75 cents (paper cover).

The forty-fourth number of the Statistical Abstract of the United States, for the year 1921, contains 942 pages, including a complete index.

The publication is an exhaustive compilation of statistical information embracing every branch of the governmental service. A total of 497 separate tables are contained in the volume setting forth up-to-date data on a great variety of subjects.

Some idea of the scope of the work may be gathered from the following sub-titles appearing in the contents pages:

1. Area, Climatic Conditions and Position.
2. National Parks, Reservations and Public Lands.
3. Irrigation and Drainage.
4. Population.
5. Vital Statistics.
6. Immigration and Passenger Movement.
7. Education and Vocational Rehabilitation.
8. Farms and Farm Property.
9. Farm Animals and Products.
10. Farm Crops.
11. Fisheries.
12. Minerals and Products.
13. Manufacturers.
14. Industrial Accidents and Fatalities.
15. Commercial Failures.
16. Public Roads and Motor Vehicles.
17. Postal Service and Telegraphs.
18. Railroad and Express Companies.
19. Freight Rates and Commerce.
20. Merchant Marine.
21. Commerce of Noncontiguous Territory.
22. Consumption Statistics.
23. Prices.
24. Money and Banking.
25. Obligations due the U. S. Government.
26. Revenue and Expenditures.
27. Insurance and Fires.
28. Public Debt.
29. Wealth and Taxation.
30. Army, Navy, Civil Service, Pensions, etc.
31. Statistical Record of the Progress of the U. S.
32. Commercial, Financial and other Statistics of the World.

The book is an excellent reference guide and forms a valuable supplementary aid to the various newspaper almanacs.

Modern Workshop Practice. By Ernest Pull. Sixth edition, rewritten and enlarged. Cloth; six hundred and seventy-one $5\frac{1}{4}$ x 8 in. pages, 552 illustrations. Published by D. Van Nostrand Co., 8 Warren St., New York City. Price $5.

This book was written by the workshop superintendent of the London (England) County Council School of Engineering and Navigation for the use of students in technical institutes and candidates for examination and entry into the Royal Navy as engine room artificers. Various types of machine tools and shop appliances are illustrated and described and some little instruction given in their use.

As a whole, the practical information contained is but little more than that given in first class advertising matter of tool builders. Regarded as a catalog of machine tools and their accessories, the book may be fairly complete from an English point of view, but it fails to meet the American standard in that class of publications. The book having lived through six editions, however, it must have some popularity among British mechanics.

Trade Catalogs

Drafting Tools. E. Lawrenz, 2533 McClellan Ave., Detroit, Mich. A new bulletin has just been issued by this manufacturer describing his line of "The Normal" drafting tools to which has been added a set of bow compasses.

Triplex Machines. The Triplex Machine Tool Corporation, 18 East 41st St., New York City. This company has just issued an interesting circular describing fully its Triplex machine, a small machine of 500 pounds weight, which is adapted for turning and boring, angular and vertical milling, horizontal milling, thread cutting and drilling. The circular contains illustrations showing the various operations.

Coxe Stokers and CEC Service. The Combustion Engineering Corporation, Broad St., New York City. This company has just issued two new publications. The larger bulletin on the Coxe stoker covers particularly the performance of this stoker on Western and Mid-Western bituminous coals. A number of test reports, each accompanied by corresponding curves are included. These tests show interesting results and because they are complete in every respect they will be of considerable value to the engineering world. A number of successful installations in some of the biggest and most important plants in the Middle West using this type of stoker on bituminous coal are shown in this bulletin. The "Service Bulletin," while it is issued by this company, will be of value to all stoker companies. At the present time it is necessary for stoker manufacturers to render gratuitously, service of a very costly nature. This booklet presents the stoker manufacturers' side of the question and shows why a proper charge for real stoker service would not only be fair to the recipient but would be to his advantage.

Forthcoming Meetings

National Personnel Association, First Annual Convention, November 8, 9 and 10, at Pittsburgh, Pa. Secretary at 20 Vesey St., New York, N. Y.

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Reduction of two points in wrought-steel pipe discounts in New York and Cleveland warehouses, following recent mill advance of $4 per ton. Steel plate demand for car, tank, ship and boiler construction, in excess of production. Plates quoted at minimum of $1.90, with maximum at $2.25, or an average price of about $2 per 100 lb., f.o.b. Pittsburgh. Shapes quoted, however, at $2@$2.10 and bars at $2@$2.15, f.o.b. mill. Tin market active; quoted in New York warehouses at 37c. as against 35c. per lb. Lead, 6.95c. as compared with 6¾c.@6⅞. last week, and zinc firmer at 7½c. as against 7⅜c. Zinc sheets up ¼c.; solder and babbitt metal 1c. per lb. in New York, during week. Cleveland advances antimony ½c.; babbitt metal 1c. and old metals, non-ferrous, ¼c. per lb.

Declines—Copper market softer but inquiries better; quoted at 14½c. as against 14¾c. per lb. in New York. Coke prices lower; decline expected in pig iron. Cast-iron washers down $1 per 100 lb. in Cleveland. Linseed oil quiet; down 3c. per gal. in Chicago. Improvement in demand for lard oil and lubricants but prices unchanged.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	33.27
Southern Ohio No. 2	33.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	35.80
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	32.64
Virginia No. 2	37.17
Basic	31.75
Grey Forge	30.50
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	31.77
Basic	31.77
Bessemer	33.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flyhweels, 6-in. wide x 24-in.o.d., hub not cored, good quality gray iron, weight 275 lb.:

New York	5½
Chicago	4@5
Cleveland	2.4
Detroit	6.0

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.85	4.19	3.70	4.00
No. 12	2.60@2.95	4.24	3.75	4.05
No. 14	2.70@3.00	4.29	3.80	4.10
No. 16	2.90@3.30	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.60	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.65	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.70	4.80	4.30	4.75
No. 28	3.35@3.75	4.90	4.40	4.85
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11.	3.35@3.85	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.95	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.25	5.30	4.80	....
Nos. 22 and 24.	3.90@4.40	5.45	4.95	5.40
No. 26	4.05@4.55	5.60	5.10	5.55
No. 28	4.35@4.85	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63.	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
3/32	8.00		12@13
⅛	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.50		
Tin, 5-ton lots, New York	37.00		
Lead (up to carlots), St. Louis	6.45@6.50; New York. 6.95		
Zinc (up to carlots), St. Louis	7.05@7.10; New York. 7.5		
	New York	**Cleveland**	**Chicago**
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	9.75	10.25	.....
Solder (½ and ½), (caselots)	26.50	23.50	20.00
Babbitt metal (83% tin)	35.00	45.00	36.00
Babbitt metal (35% tin)	25.00	17.25	9.00
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.75	12.00
Copper, heavy, and wire	11.75	12.25	11.50
Copper, light, and bottoms	9.75	10.25	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.75	6.00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3.00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	6.00	7.25
IC,	14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.94
White lead, dry or in oil	100 lb. kegs.	New York, 12.75	
Red lead, dry	100 lb. kegs.	New York, 12.75	
Red lead, in oil	100 lb. kegs.	New York, 14.25	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville...per net ton		$8.00	
Coke, prompt foundry, Connellsville...per net ton		10.50@12.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ½ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ¾ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Conn., Danbury—J. W. Leahy, 29 Crosby St., (machine works)—one ¾ in. and one 1¼ in. model B Cleveland automatic screw machines.

Fla., Marianna—Consolidated Motor Co., L. Williams, Secy.—machine shop equipment.

Ill., Chicago—The Chicago & Northwestern Ry. Co., F. G. Berck, Boone, Ia., Purch. Agt.—one 42 in. drill press; one 15 in. drill press; two 18 in. engine lathes, 4 ft. between centers; two 20 in. engine lathes, 6 ft. between centers; two hollow hexagon turret lathes, Warner & Swasey No. 2 A universal or equivalent; one centering machine for 3 in. stock; one large quick work power hammer with set of dies; one spot welding machine, equal to No. 254 Thompson Welder Co. machine to weld No. 22 to No. 3 B. & S. gauge iron and steel; three double dry grinding emery wheel stands with 2 x 18 in. wheels and 1¾ in arbors; also three power hack saws, Marvel No. 4.

Ill., Chicago—J. A. Dunn Co., 2911 South LaSalle St. (manufacturer of chairs)—one Hawker, dowel turning machine (used).

Kan., Wichita — Garry Sales Co., 315 South Market St., T. H. Cooper, Purch. Agt.—complete equipment for garage, including drill press, lathe, emery stand, hangers, bearings, shafting, pulleys and small tools.

Mass., Boston—J. L. Gleason & Co., 241 Franklin St., (electrical contractors), J. L. Gleason, Mgr.—several electric drills for shop work (used).

Mass., Boston—G. G. McLaughlin Mfg. Co., 24 Washington St., N. (machine shop) —one 12 in. four sided moulder (used).

Mass., Boston—M. Strauss, 53 Merrimac St., (sheet metal worker)—automatic punch, automatic shears, squaring shears and electric drill (used).

Mich., River Rouge—Whitehead & Kales Co. (structural steel)—spacing machine, punch, angle shear for large sizes.

Mo., St. Louis — Lubrite Refining Co., 1812 Arcade Bldg.—pipe cutting machine, from 1 to 6 in. capacity, with die, belting and shafting.

Mo., St. Louis—Western Screw Products Co., 3219 South Bway.—automatic and hand screw machines, engine lathes, carbonizing outfit, oil extractor, drill presses, nut tappers, McKenzie chip and product separator and computing scales (new or used).

N. Y., Buffalo—J. H. Aspden, 312 Niagara St.—machinery and equipment for automobile repair and machine shop on South Park and Woodside Aves.

N. Y., Buffalo—Birk-Notman Motor Co., 1079 Hertel Ave.—machinery, tools and equipment for proposed $30,000 garage and service station.

N. Y., Buffalo—A. J. Hansen, 185 Goodell St.—equipment for automobile repair shop.

N. Y., Buffalo—M. Katz, Ellicott Sq.—machinery, tools and equipment for automobile service station and repair shop at 1443 Main St., rear.

N. Y., Buffalo—H. H. Masters, 87 Virginia Pl.—machine shop equipment.

N. Y., Buffalo—C. S. McDonough, 1148 Niagara St.—equipment for garage, including 1,000 gal. gas tank and pump.

O., Cleveland—Bd. Educ., Rockwell Ave. and East 6th St.—squaring shears, bar folding machine, punch and shear combined, burring machine, turning machine, woodworking machinery and miscellaneous shop equipment for John Adams Sr. High School.

O., Columbus — The Althoff Plating & Polishing Co., 212 North Grant Ave., J. G. Althoff, Purch. Agt.—polishing equipment and bending machine.

O., Columbus—The Ohio State Stove & Mfg. Co., foot of Buttles Ave., M. L. Becker, Genl. Mgr.—automatic press, 20,000 lb. capacity, also equipment for addition to plant.

Pa., Ambridge—H. H. Robertson Co.—multiple punching machine for 18 gauge metal.

Pa., Pittsburgh — Guibert Steel Co., Diamond Bk. Bldg. (steel fabricating), E. R. Bechtel, Purch. Agt.—punches, shears and boring machinery.

Tenn., Knoxville — The Cherokee Motor Co., 314 State St., C. Reed, Pres.—equipment for proposed addition to garage and service station.

Tenn., Union City—W. Warmuth (sheet metal worker)—one set of power sheet bending rolls.

Tex., Columbus—Gimmer Tanner Gravel Co.—machine and forge shop equipment to replace that which was destroyed by fire.

Va., Richmond—Night & Day Service Co., 900 West Broad St., C. B. Hatch, Purch. Agt.—lathe and drill press.

Va., Richmond—Thompson Auto Repair Co., 509 West Marshall St.—lathe and drill press.

Wis., Kiel — Hingess & Bessler, c/o A. Hingess—automobile repair machinery for proposed $45,000 garage at Chilton.

Wis., Milwaukee—J. P. Meehan, 266 27th St. (garage)—drill press and air compressor.

Wis., Milwaukee—Thust Machine Co., c/o L. N. Biron, 306 Mitchell Bldg.—machine tools for the manufacture of glueing and wrapping machines for making paper boxes.

Wis., Wausau—D. J. Murray Mfg. Co., 1002 3rd St., (manufacturer of saw mill machinery), D. L. Bellinger, Purch. Agt.—drill press, lathe, grinders and small tools (used preferred).

Ont., Guelph—B. Tolton & Son, 173 Woolwich St.—garage and repair shop equipment to replace that which was destroyed by fire.

Ont., St. Thomas—City Gas Dept., E. H. Caughell, City Hall, Engr.—one 16 in. x 8 ft. lathe, screw cutting; one 20 in drill, back gear, self feed; one 10 x 14 in. shaper.

Machinery Wanted

Ala., Birmingham — Western Newspaper Union, 213 North 17th St.—Cottrell or Omaha press with folder.

Ark., Pine Bluff—Merit Veneer & Box Co., Inc., J. Dent, Dir.—machinery and equipment for the manufacture of wire bound boxes, crates and veneer box products.

Ark., Thornton—The Stout Lumber Co.—machinery and equipment for proposed lumber mill, to replace that which was destroyed by fire.

Calif., Nipinnawasee — S. G. Smartt (woodworker)—power planer.

Calif., San Francisco—G. Lomer, 378 3rd St.—small tools for cabinet work.

Fla., Fort White—Fort White Package Co. (wooden box manufacturer)—machinery and equipment for plant.

Ill., Chicago—Central Storage Co., 1422 St. Louis Ave.—electric crane and derrick.

Ill., Chicago—M. M. Rothschild, 712 Federal St.—two color automatic presses.

Ill., Chicago—Wanner Machine Co., 716 South Dearborn St. (printers' supplies)—26 x 34 Miehle press, power paper cutter and a small power job press (used).

Ill., Chicago—W. E. Williams, 332 South La Salle St.—electric spot welder (used).

Ind., Bedford—The Democrat—12 x 15 in. job press, belting, hangers, pulleys and shafting for motor power.

Kan., Abilene—The Chronicle—linotype, model No. 1 preferred.

Mass., Cambridge — Hingham Knitting Co., Charles River Parkway, (knit goods)—3½ in. cylinders for 200 needle "Banner" knitting machines.

Mass., East Boston (Boston P. O.)—A. Martin, 193 Trenton St.—laundry machinery and equipment, including several four pocket washers and extractors (used).

Mass., North Leverett—D. Glazier (woodworker)—55 ft. of 16 in. 2 ply leather belt, also miscellaneous belting in smaller widths and lengths.

Mass., Somerville — The Progressive Laundry, 203 Pearl St.—extractor, washing machines, dryer, etc. (used).

Mich., Detroit — J. Jesseph, 8941 West Jefferson St. (cabinet maker)—power band saw.

Mich., Grand Haven—Daily Tribune—magazine for model No. 5 linotype.

Mich., Highland Park—Ford Motor Co.—miscellaneous equipment for the manufacture of plate glass and converting it into wind shields.

Mich., Highland Park—Ford Motor Co.—gas producers, also coal and ash handling equipment for proposed gas producer plant at Flat Rock.

Mich., Highland Park—Ford Motor Co.—overhead cranes, conveyors, etc., for proposed transfer building.

Mo., Kansas City — Bauer-The-Woodworker, 111 West 18th St., A. Bauer, Purch. Agt.—Universal woodworker.

Mo., Kansas City—Bd. Educ., Purchasing Dept.—floor surfacing machine for Lathrop Manual Training School.

Mo., Kansas City—Kansas City Journal-Post, 8th and McGee Sts.—printing equipment.

Mo., Kansas City—W. Pierce, 2026 Campbell St.—oil well driller.

Mo., Kansas City—Rutherford Flavoring Co., 1619 East 8th St., M. Rutherford, Purch. Agt.—canning retorts.

Mo., St. Louis—E. Stempfle, 4004 Lincoln Ave. (woodworker)—small band saw, 28 or 30 in., motor driven.

Mo., St. Louis — Western Newspaper Union, 3rd and Walnut Sts.—one 10 x 15 in. job press.

Neb., Omaha — Bd. Educ., c/o W. T. Bourke, Secy., 603 City Hall—manual training equipment for proposed $750,000 high school.

N. H., Keene—Keene Silk Fibre Mills—gas or electric singeing machine for silk yarn.

N. H., Nashua—The International Paper Box Machine Co., 315 Main St.—milling machine, planer type, slab miller, 12 to 14 ft. table, 30 in. between housings (used).

N. J., Englishtown — The Englishtown Carpet Co., A. Muldoon, Pres.—twenty looms for proposed factory.

N. Y., Avoca—Avoca Weekly News, G. Peterson, owner—printing machinery and equipment to replace that which was destroyed by fire.

N. Y., Avon—A. J. Stewart—one wood turning lathe.

N. Y., Buffalo—F. Ahrens, 1262 Genesee St.—machinery for the manufacture of candy.

N. Y., Buffalo—E. J. Alberson, 819 Tonawanda St.—equipment for bakery.

N. Y., Buffalo—F. Beck, Abbot Rd. and Kimmel St.—machinery and equipment for proposed factory for mechanically curing and smoking boiled hams.

N. Y., Buffalo—Drouillard Mfg. Co., 460 East Eagle St.—machinery for the manufacture of ice cream cones.

N. Y., Buffalo—J. Grebaum, 1869 Niagara St.—14 x 21 in. Universal or Pearl printing press.

N. Y., Buffalo — The Mary Lee Candy Shoppe, 1123 Bway.—machinery for the manufacture of candy.

N. Y., Buffalo—R. M. Murphy, 153 Wallace Ave.—bakeshop equipment

N. Y., Buffalo—R. J. Sweet, 1189 Niagara St.—welding and machine repairing machinery.

N. Y., Buffalo—W. T. Teese, 1087 Genesee St.—welding equipment for electric welding shop.

N. Y., Buffalo—G. Urban Milling Co., 200 Urban St.—equipment for blacksmith shop.

N. Y., Canajoharie—Beech Nut Packing Co.—equipment for proposed branch factory at Hamilton, Ont.

N. Y., Dunkirk—Continental Heater Co., Otter St.—machinery for proposed addition to plant for the manufacture of boiler parts and cores.

N. Y., Jamestown—Bd. Educ.—vocational equipment for proposed $350,000 junior high school.

N. Y., Lake View—Acme Shale & Brick Co.—machinery and equipment for proposed tile manufacturing factory on the Pierce Farm.

N. Y., New York—A. G. Schoonmaker, 25 Church St.—air coupressor 2 cylinder type, 140 to 160 cu.ft.

N. Y., Olean—Kulp, Inc., C. W. Kulp, Pres.—machinery and equipment for the manufacture of art goods and novelties.

N. Y., Palmyra—Palmyra Pump & Accessories Co.—machinery and equipment for proposed plant for manufacturing patented headlight non-glaring device for automobiles.

N. Y., Rochester—M. D. Knowlton Co., 28 Industrial St., manufacturer of paper boxes—machinery and equipment for proposed addition to plant.

N. Y., Rochester—Newman Bros. Grain Co., 304 Troup St.—milling equipment for proposed addition to grain mill.

N. Y., Rochester—W. B. Williams, 295 Monroe Ave.—equipment for proposed addition to paint shop.

N. Y., Rochester—Wood Specialties, Inc., 124 Railroad St.—one variety saw table.

N. Y., Wilson—Niagara County Preserving Co.—small power hydraulic press.

O., Canton—Klingstedt Bros. Co., Cleveland Ave., V. W. Klingstedt, Purch. Agt.—machinery and equipment for proposed $75,000 printing plant.

O., North Canton — Hoover Suction Sweeper Co.—additional machinery and equipment.

O., St. Clairsville—H. G. Nichol, Box 176—power paper cutter.

O., Warren — The Alloy Electric Steel Casting Co. (manufacturer of electric furnace and open hearth steel castings)—machinery and equipment for new plant.

Okla., Tulsa—W. Huddleson, R. R. No. 4—$2,000 worth of newspaper equipment, including job press and newspaper press.

Ore., Philomath—The Review—6 or 7 column folio newspaper press.

Pa., Ashland — Bd. Educ. — vocational equipment for new $125,000 high school.

Pa., Bridgeport—Bd. Educ.—vocational equipment for proposed high school.

Pa., Coopersburg—The Coopersburg Improvement Co.—machinery and equipment for new granite polishing plant.

Pa., Corry—Bd. Educ.—vocational equipment for new $125,000 school.

Pa., Erie—A. Baker, 2415 Wayne St.—22 in. paper cutting machine.

Pa., Freeland — Washington Silk Co. — machinery and equipment for silk manufacturing factory.

Pa., Girard — Girard Model Wks., Inc., S. L. Connell, Dir.—machinery for the manufacture of wire shapes, small springs and mechanical toys.

Pa., Lansford—Lehigh Coal & Navigation Co.—machinery and equipment for $45,000 coal washing plant at Tamaqua, to replace that which was destroyed by fire.

Pa., Meadville—The Meadville Iron Co., Inc., Mill St.—machinery and equipment for one story addition to iron works.

Pa., New Castle—The Newcastle News, F. Rentz, Mgr.—motors, shafting, belting and hangers.

Pa., New Holland—Bd. Educ.—vocational equipment for proposed $100,000 school.

Pa., Oil City—Oil City Boiler Wks., 351 Seneca St.—machinery and equipment for large addition to factory.

Pa., Phila.—Electric Storage Battery Co., 19th and Allegheny Sts.—equipment for proposed branch factory in Kansas City, Mo.

Pa., Pringle (Wilkes-Barre P. O.)—Bd. Educ.—vocational equipment for proposed $85,000 school.

Pa., Reading—J. Biehl Wagon & Auto Wks., 31 South 5th St.—machinery and equipment for new two story plant for the manufacture of automobile parts and equipment, at West Reading.

Pa., Rochester—M. R. Regan—carload of thread protectors.

Pa., Throop — Bd. Educ.—vocational equipment for new $175,000 school.

Pa., Towanda—Bradford County Coal & Oil Co., J. Conklin, Dir.—pumping machinery and drilling equipment for new oil well.

Pa., Troy—Bd. Educ.—vocational equipment for proposed $100,000 high school.

Pa., Uniontown—Provant Coal Co.—machinery and equipment for new coal tipple, fan house and mechanical draft department.

Pa., Warren—J. T. Newell, 244 Penn Ave.—additional machinery and equipment for proposed 4 story printing plant on Liberty St.

R. I., Pawtucket — Lumb Knitting Co., Central Ave.—cylinders and dials, 14 cut, for 17, 18, 19, 20, 21 and 22 in. body machines.

R. I., Providence—Eddy Finishing Co., H. A. Clason, 1008 Turks Head Bldg., Purch. Agt.—cotton goods printing and dyeing machinery for plant (being organized).

S. D., White Lake—The White Lake Cooperative Creamery Assn., J. L. Jensem, Secy. and Mgr.—cream vats, paraffiner, tester, rotary and deep well pumps, shafting, hangers, belting, mostly double leather, pulleys, water storage tanks, pipes and fittings, pipe cutting tools, vise, dies, etc.

Tenn., Chattanooga—The Dixie Spinning Mills—complete machinery for spinning mill.

Tex., Fort Worth—Southwest, 844 Monroe St. (newspaper)—power job press and paper cutter.

Tex., Kenedy—The Kenedy Ice & Electric Co.—laundry equipment.

Va., Petersburg—Petersburg Printing & Stationery Co., 17 East Bank St.—cylinder printing press.

Va., Richmond—T. W. McCabe, 20 South 10th St. (manufacturer of cornices, ventilators and roofing)—one steel cornice brake and one burring machine.

Va., Richmond—The Rosenthal Printing Co., 412 East Main St.—one large cylinder press.

Va., Winchester — Winchester Lumber Co., W. B. Cornell, Pres.—machinery and equipment for proposed lumber mill at Gore.

Wis., Auburndale—W. Schmidt (grist mill)—feed grinding machinery, gasoline engine or motor power.

Wis., Cuba—J. Selleck & Co.—zinc mining and crushing machinery.

Wis., Jump River—Crane Lumber Co.—saw mill machinery, belting, shafting and hangers.

Wis., Kaukauna—The Ground Wood Pulp Supply Co.—machinery and equipment, including grinders, for proposed pulp mill.

Wis., Kaukauna—P. A. Mitchell—storage tanks, pumps and equipment for proposed filling station.

Wis., Marshfield — Roddis Lumber & Veneer Co., East 2nd St., H. Roddis, Purch. Agt.—medium size planer.

Wis., Milwaukee — The Natl. Knitting Co., 905 Clinton St.—knitting machines for proposed addition to factory.

Wis., Milwaukee—E. F. Seybold, 342 6th St. (produce)—refrigeration machinery.

Wis., Park Falls—Hines Lumber Co.—power machinery for proposed $75,000 saw mill at Loretta near Draper.

Wis., Racine—Racine Pine Mills Co., 1010 13th St. (dairy products)—steam driven refrigeration machinery.

Wis., Slinger—L. A. Burg—storage tanks and pumps for proposed garage.

Ont., Brantford—Brantford Roofing Co., Ltd. (manufacturer of asphalt roofing products), C. M. Thompson, Mgr.—roofing machinery.

Ont., Hamilton—Standard Underground Cable Co. of Canada, Ltd., T. D. Waring, Mgr.—machinery for stranding and cabling of wire and cables, also electrically driven pumps for operating hydraulic presses.

Ont., Stratford—W. W. Camp (manufacturer of peat)—machinery and equipment for the manufacture of briquettes.

Ont., Windsor—Wilkie Products Co., 312 Pitt St., W.—equipment for proposed factory for the manufacture of piston rings and garage equipment at Tillsonburg.

Que., Montreal — Howard Smith Paper Mills, Ltd., 138 McGee St., C. H. Smith, Pres.—complete equipment for bleached soda pulp plant.

Australia, New South Wales, Sydney—L. P. R. Bean & Co., Ltd., 229 Castlereagh St. (electrical engineers and importers of electrical supplies and machinery), L. P. R. Bean, Purch. Agt.—refrigerating machinery for restaurants, hotels and domestic use, also ice making machines, electrically operated.

Metal Working Shops

Ala., Bessemer—The Nashville Bridge Co., Shelby Ave., Nashville, Tenn., will build a fabricating plant, here. Estimated cost $85,000. A. J. Dyer, Pres.

Calif., Chico—Chico High School District will build a shop building for the high school. Estimated cost $20,000. R. H. Camper, Secy.

Calif., Fresno—The United Engine & Machine Co. plans to build a machine shop, foundry and molding shop, pattern shop and forge building for the manufacture of heavy castings, valves and piston rings as a specialty.

Calif., San Francisco — The city and county of San Francisco, Bd. of Park Comrs., Park Lodge, Golden Gate Park, will soon receive bids for the construction of repair shops and sheds. Estimated cost $24,400.

Conn., Bridgeport — The Belknap Mfg. Co., Union Ave., awarded the contract for the construction of a 2 story, 20 x 60 ft. addition to its plant for the manufacture of water fittings. Estimated cost $12,000.

Ill., Chicago—F. D. Chase, Inc., Archts., 645 North Michigan Ave., receiving bids for the construction of a 1 story, 124 x 173 ft. factory at 5800-5814 Throop St., for the Goldsmith Bros. Smelting & Refining Co., 29 East Madison St. Estimated cost $55,000.

Ill., Chicago — L. G. Hallberg & Co., Archts., 116 South Michigan Ave., receiving bids for the construction of a 1 story, 30 x 112 ft. factory on 103rd St. and Hoyne Ave., for the Chicago Steel & Wire Co., 10257 Torrence Ave. Estimated cost $15,000.

Ill., Chicago—T. G. Hallberg & Co., Archts., 116 South Michigan Ave., will soon receive bids for the construction of a 1 story, 68 x 190 ft. addition to garage for Huguelot Bros., 908 Gary St. Estimated cost $50,000.

Ill., Elgin—The Elgin Stove & Oven Co., 14 Chicago St., awarded the contract for the construction of a 3 story factory on State and Schiller St. Estimated cost $100,000. Noted Feb. 23.

Ky., Ashland — The Amer. Rolling Mill Co. awarded the contract for the construction of an addition to its plant, including a jobbing and sheet mill, also a galvanizing plant.

Mass., Hyde Park (Boston P. O.)—The Tileston & Hollingsworth Co., 49 Federal St., Boston, manufacturer of paper and cardboard, awarded the contract for the construction of a 1 story addition to its machine shop, here. Estimated cost $40,000.

Mass., Somerville — C. R. Bowlby, 16 Thorndike St., West Somerville, will build a 4 story, 60 x 75 ft. garage on Buena Vista Rd., here. Estimated cost $40,000.

Mich., Flat Rock—A. Kahn, Archt., 1000 Marquette Bldg., Detroit, is receiving bids and will open same about Nov. 4 for the construction of a 2 story, 59 x 148 ft. gas producer plant, including coal hopper, here, for the Ford Motor Co., Highland Park.

Minn., St. Paul—The American Radiator Co., 1807 Elmwood Ave., Buffalo, N. Y., is having plans prepared for the construction of a plant for the manufacture of radiators, including foundry, machine shop, warehouses, etc., on a 525 x 120 ft. site, on Prior Ave., here. Estimated cost $1,500,000. J. F. Groebe, c/o owner, Engr.

Mo., Joplin—The Norton Taxicab Co., 6th and Wall Sts., plans to build a 2 story, 100 x 155 ft. garage and machine shop at 520 Wall St. Estimated cost $35,000. V. Norton, Pres. Architect not selected.

Mo., Kansas City—The Electric Storage Battery Co., 19th and Allegheny Sts., Phila., Pa., awarded the contract for the construction of a 1 story, 160 x 220 ft. branch factory on Belmont St., here. Estimated cost $150,000.

N. J., Trenton — The Eberhard Watch Corp., Commonwealth Bldg., plans to build a plant for the manufacture of watches. G. F. Eberhard, Pres.

N. Y., Dunkirk—The Continental Heater Co., Otter St., awarded the contract for the construction of a 1 story, 64 x 220 ft. addition to its plant for the manufacture of boiler parts and cores.

N. Y., New York—The Canter Constr. Co., c/o F. Parker, Engr. and Archt., 44 Court St., Brooklyn, will build a 2 story, 150 x 195 ft. garage on Park Ave. and 164th St., here. Estimated cost $150,000.

N. Y., New York—The 425 West 54th St. Realty Co., c/o F. A. Rooke, Engr. and Archt., 15 East 40th St., will build a 6 story, 75 x 90 ft. garage at 421 West 54th St. Estimated cost $125,000. C. Scott, Pres.

N. Y., New York—The Transit Comn., 49 Lafayette St., awarded the contract for the construction of foundation for the third addition to its shops on Lenox Ave. and 148th St. Noted Oct. 19.

O., Cleveland — The Lees-Bradner Co., 6210 Carnegie Ave., manufacturer of machine tools, is having plans prepared for the construction of a 3 story addition to its factory. Estimated cost $100,000. E. G. Lees, Pres. Private plans.

O., Cleveland — The National Screw & Tack Co., c/o F. G. Walker, 2440 East 75th St., is having plans prepared for the construction of a 5 story factory on Platt Ave. near East 76th St. Estimated cost $400,000. F. G. Walker, c/o owner, Archt.

O., Cleveland—The Otis Steel Co., c/o R. Brakeman, Engr. and Archt., 3341 Jennings Rd., is having plans prepared for the construction of a 1 story steel mill, including blooming mill, strip mill and open hearth furnaces, on Jennings Rd. Estimated cost $3,000,000.

O., Cleveland — The Vance Motor Co. (Ford agents) awarded the contract for the construction of a 2 story, 63 x 132 ft. garage on East 9th St. and Central Ave. Estimated cost $100,000.

O., Cleveland Heights (Warrensville P. O.)—The Heights Battery Co., c/o J. Herman, 2777 Mayfield Rd., awarded the contract for the construction of a 2 story, 50 x 100 ft. garage at 2770 Mayfield Rd. Estimated cost $40,000. Noted June 2, 1921.

O., East Cleveland — The Pollock-Davis Co., 11628 Euclid Ave., awarded the contract for the construction of a 2 story, 72 x 74 ft. garage. Estimated cost $40,000.

O., Kent—The Lamson & Sessions Co., 2188 Scranton Rd., Cleveland, manufacturer of nuts, bolts and rivets, have had plans prepared for the construction of a 1 story, 168 x 200 ft. factory, here. Estimated cost $125,000. G. S. Rider & Co., Century Bldg., Engrs. and Archts.

Pa., Ambridge — The National Metal Moulding Co. will build a 1 story, 98 x 100 ft. cafeteria and shop building.

Pa., Coraopolis — The Standard Steel Spring Co. awarded the contract for the construction of a 1 story, 64 x 141 ft. factory building. Noted June 22.

Pa., McKees Rocks—The Federal Enameling & Stamping Co., Thompson Ave., will build a 3 story factory for the manufacture of tin and enameled wares.

Pa., Phila. — Neubauer & Supowitz, Archts., 929 Chestnut St., are receiving bids for the construction of a 2 story, 50 x 100 ft. garage and hall on Wyoming Ave. and Mascher St., for P. Randolph, 41 East Poplar St. Estimated cost $100,000.

Pa., Pittsburgh—The Fleishman Yeast Co., 801 Washington St., New York City, awarded the contract for the construction of a 2 story, 75 x 192 ft. agency and garage building on Allegheny and Western Sts., here. Estimated cost $50,000. Noted June 22.

Pa., Tamaqua—The Lehigh Coal & Navigation Co., Lansford, plans to rebuild its coal washing plant which was recently destroyed by fire, here. Cost between $45,000 and $50,000.

Tenn., Knoxville — The Cherokee Motor Co., 314 State St., plans to build a 3 story, 100 x 150 ft. addition to its garage and repair shop. Estimated cost $75,000. C. Reed, Pres.

W. Va., Huntington—The Armstrong Mfg. Co. awarded the contract for the construction of a 1 story, 108 x 201 ft. addition to its plant for the manufacture of hardware and specialties. Noted Oct. 19.

Wis., Chilton—Hingess & Bessler, c/o A. Hingess, Kiel, plans to build a 2 story, 60 x 100 ft. garage, here. Estimated cost $45,000. Architect not selected.

Wis., Milwaukee — The Milwaukee Air Pump Co., 886 3rd St., awarded the contract for the construction of a 1 story, 130 x 150 ft. factory and office building on Keefe Ave. Estimated cost $50,000. Noted Oct. 5.

Wis., Slinger—L. A. Burg will build a 1 story, 60 x 90 ft. garage. Estimated cost $40,000. Noted Oct. 12.

Wis., West Bend—The Amer. Service & Storage Garage, c/o M. A. Johannes, Ashford, R. D., Campbellsport, awarded the contract for the construction of a 1 story, 60 x 80 ft. garage. Estimated cost $40,000. Noted Oct. 19.

Ont., Guelph—B. Tolton & Son, 173 Woolwich St., plan to rebuild their garage and repair shop which was destroyed by fire. Estimated cost $45,000.

Ont., Tillsonburg—The Wilkie Products Co., 312 Pitts St., W., Windsor, Ont., plans to build a 60 x 200 ft. factory for the manufacture of piston rings and garage equipment, here. Estimated cost $100,000.

General Manufacturing

Ala., Birmingham—The city awarded the contract for the construction of a 2 story, 140 x 200 ft. market house, including complete refrigerating plant on 3rd Ave. and 23rd St. Estimated cost $195,000.

Ala., Birmingham—The Lehigh Portland Cement Co., Young Bldg., Allentown, Pa., awarded the contract for the construction of a cement mill, capacity 1,000,000 bbl. per year, here. Noted Oct. 5.

Ark., Thornton—The Stout Lumber Co. plans to rebuild its lumber mill which was destroyed by fire. Estimated cost $200,000.

Calif., Fresno—Black's Package Co., 1025 Van Ness Ave., is having plans prepared for the construction of a 2 story, 200 ft. frontage, stores building and refrigerating plant. Estimated cost $150,000. R. F. Felchlin Co., Bank of Italy Bldg., Engrs. and Archts.

Calif., San Francisco — P. Grassi, 808 Arguello Blvd., awarded the contract for the construction of a 1 story, 120 x 120 ft. marble and terrazzo products factory on San Bruno Ave. Estimated cost $5,000.

Ill., Chicago—E. J. Brach & Sons, 215 West Ohio St., awarded the contract for the construction of a 3 story, 100 x 300 ft. candy factory on Kinzie and Cicero Sts. Estimated cost $1,000,000. Noted Oct. 19.

Ill., Chicago—The Imperial Box Co., Inc., 1506 Carroll St., awarded the contract for the construction of a 1 story, 70 x 110 ft. factory at 1536-40 Carroll Ave. Estimated cost $25,000.

Ia., Sioux City—The Hanford Produce Co., 1st and Court St., awarded the contract for the construction of a 3 story, 100 x 150 ft. cold storage warehouse and ice plant on 1st and Virginia Sts. Estimated cost $100,000.

Me., Lewiston—The Bates Mfg. Co. has had plans prepared for the construction of a 4 story, 170 x 370 ft. addition to its plant for the manufacture of gingham goods. Estimated cost $600,000. Architect not announced.

Mass., Everett—Stone & Forsyth Co., 67 Kingston St., Boston, awarded the contract for the construction of a 2 story, 18 x 46 ft. addition to its paper plant on Spring St., here. Estimated cost $15,000.

Mass., Fall River—The Sagamore Mfg. Co., Benefit St., awarded the contract for the construction of a 2 story, 75 x 96 ft. addition to its plant No. 1. Estimated cost $40,000.

Mass., Somerville—The Mitchell Bakery Co., South St., Cambridge, awarded the contract for the construction of a 1 story, 65 x 90 ft. bakery on Vine St., here. Estimated cost $30,000.

Mich., Flat Rock—A. Kahn, 1000 Marquette Bldg., Detroit, is receiving bids and will open same about Nov. 4, for the construction of a 1 story, 242 x 761 ft. plate glass factory, here, for the Ford Motor Co., Highland Park. Estimated cost $1,500,000.

N. J., Englishtown — The Englishtown Carpet Co. awarded the contract for the construction of a 2 story, 50 x 75 ft. carpet factory. Estimated cost $12,000. A. Muldoon, Pres.

N. J., Lambertville—The Jesperson Newsprint Corp. plans to rebuild its paper factory to replace the one which was recently destroyed by fire.

N. Y., Alfred—Reynold Bros. plan to rebuild their 4 story cheese factory and warehouse, which was destroyed by fire. Cost between $50,000 and $60,000. Architect not announced.

N. Y., Buffalo—The Pillsbury Flour Mills Co., 302 Metropolitan Life Bldg., Minneapolis, Minn., awarded the contract for the construction of a 10 story, 100 x 268 ft. flour mill, here. Estimated cost $1,000,000. A. C. Loring, Pres. Noted Oct. 19.

N. Y., Jamestown—The Alliance Furniture Co., Allen St., awarded the contract for the construction of a 4 story addition to its factory, to contain 20,000 sq.ft. floor space. Cost will exceed $35,000. Noted Oct. 12.

N. Y., Jamestown — The Empire Case Goods Co., 142 Foote Ave., awarded the contract for the construction of a 2 story addition to its furniture factory, to contain 7,000 sq.ft. floor space. Noted Oct. 12.

N. Y., Rochester—The Newman Bros. Grain Co., 304 Troup St., plans to build an addition to its grain mill. Estimated cost $25,000. Architect not announced.

Pa., Phila.—The J. B. Stetson Co., 5th St. and Columbia Ave., is having plans prepared for the construction of an 8 story, 62 x 75 ft. hat factory, a 1 story, 114 x 114 ft. garage and workshop, and a 1 story, 75 x 124 ft. machine and repair shop on 4th St. and Columbia Ave. J. O. Potts, 5th St. and Montgomery Ave., Archt.

Tenn., Kingsport—The Mead Fibre Co. awarded the contract for the construction of a 2 story, 75 x 275 ft. paper mill. Estimated cost $350,000. Noted Oct. 5.

Wash., Tacoma—The Northern Furniture Co., South Water St., Sheboygan, Wis., is receiving bids for the construction of a 4 story, 110 x 150 ft. furniture factory on Edison St., here. Estimated cost $60,000. W. C. Weeks, 720 Ontario Ave., Sheboygan, Wis., Archt.

Wis., Delevan—The State Bd. of Control, M. J. Tappins, Secy., Madison, awarded the contract for the construction of a 1 story cold storage plant, here. Estimated cost $40,000.

Wis., Fond du Lac—The Model Laundry Co., 66 Macy St., plans to build a 2 story, 60 x 90 ft. addition to its laundry, etc. Estimated cost $40,000. Architect not selected.

Wis., Green Bay—E. J. Balza Co., 327 Main St., is having plans prepared for the construction of a 2 story, 50 x 95 ft. pickle factory. Estimated cost $40,000. E. J. Balza, Mgr. Private plans.

Wis., Green Bay—Brown County, c/o H. F. Wittig, Clk., Court House, will build a 2 story, 70 x 95 ft. laundry. Estimated cost $40,000. Noted Sept. 14.

Wis., Green Bay—The Fairmont Creamery Co., 200 North Bway., awarded the contract for the construction of a 2 story, 100 x 105 ft. dairy and power boiler house. Estimated cost $60,000. Noted Sept. 21.

Wis., Milwaukee — The Air Reduction Sales Co., 2236 South Lumber St., Chicago, awarded the contract for alterations to its 1 story factory on Buffum St., here. Estimated cost $30,000.

Wis. New Holstein—The New Holstein Canning Co. will build a 1 story, 60 x 160 ft. canning factory. Estimated cost $40,000. A. T. Hipke, Secy.

Wis., Oconto—The Elsnore Veneer Co. will build a 1 story, 90 x 150 ft. veneer factory. Estimated cost $40,000. J. O. Atwater, Mgr. Noted Oct. 5.

Wis., Plymouth—The Phenix Cheese Co. is having plans prepared for the construction of a 5 story, 30 x 60 ft. cheese factory. Estimated cost $60,000. R. A. Harbach, Mgr. Singer-Pe[illegible]stein Co., 9 South Clinton St., Chicago, Archts. Noted Aug. 29.

Wis., Racine—The Belle City Malleable Iron Co. plans to build a 1 story, 45 x 50 ft. gas plant for annealing and core ovens. Estimated cost $40,000. C. S. Anderson, Mgr. Architect not selected.

Wis., Racine—The Davies Shoe Mfg. Co., Northwestern and Carlisle Sts., plans to build a 2 story, 75 x 150 ft. shoe factory. Estimated cost $100,000. C. Davies, Pres. Architect not selected.

Wis., Racine — The Wisconsin Gas & Electric Co., 305 6th St., awarded the contract for the construction of a 1 story, 50 x 95 ft. gas plant. Estimated cost $40,000. Noted Aug. 17.

Wis., Union Grove — The State Bd. of Control, M. J. Tappins, Secy., 902 Garfield St., Madison, awarded the contract for the construction of a 1 story, 50 x 90 ft. laundry at the Wisconsin Home for Feeble Minded, here. Estimated cost $40,000. Noted Oct. 5.

Wis., West Bend—The West Bend Concrete Products Co. awarded the contract for the construction of a 2 story, 50 x 65 ft. factory for the manufacture of drain tile and concrete products. Estimated cost $40,000.

B. C., Powell River—The Powell River Co., Ltd., is having plans prepared for the construction of a 2 story, 80 x 360 ft. addition to its paper mill. Estimated cost $200,000. R. Bell-Irving, Powell River, Archt.

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Storage and Disbursement of Small Tools

The Different Ways of Keeping Track of Tools—Single and Double Check Systems—The Register System—Check Room of the Future

BY W. J. SANSOM

A MODERN tool storage and disbursement system, in order to be efficient, should be based upon the principle of "a place for everything and everything in its place." When any particular system is selected as being best fitted to the conditions obtaining, there must be consistent and persistent fulfillment of all details connected therewith, for it is well known that an intermittent system is worse than no system at all. Care should be taken to install the system that will best suit the condition and that provides for the upkeep of the tools. A plant manufacturing a standard product, year in and year out, can install a different method of disbursement of tools from that desirable where the product is subject to change. Therefore the writer will explain how various systems are applied and to which class of shop each one is suited.

In addition to the problem of disbursement, attention will be given to the storage, ordering, maintenance, inspection and final disposition of tools, together with suggestions for blank forms to be used in connection with the different systems outlined. It is earnestly recommended that a capable man with good mechanical training be placed in charge of the tool service department. He should be a man in whom confidence can be placed to direct intelligently all phases of the work such as the ordering of small tools, repair parts for machinery and the maintenance of small tools for the entire plant, one who is broad-minded enough to settle disputes that are bound to arise with the workmen and adjust these differences to the satisfaction of and with justice to both employer and the employee. Such a man, who in addition to the foregoing qualifications can take care of the details, it is the details that count in this branch of factory management, is a valuable asset to any organization.

TOOL CHECKING SYSTEMS

The single check system is the one in common use and, contrary to general belief, is not very efficient as there are greater opportunities for losses than appear upon first consideration. The employee, when he applies for tools, is given a check number which is recorded and serves as an identification. A stated number, usually ten, of stamped metal checks bearing this identification number are then issued and the workman, upon making a request for a tool, will leave one of these checks to be placed in the bin from which the tool is taken. When the tool is returned it is again placed in the bin and the check returned to the workman.

The double check system involves a set of checks with the workman's identification number stamped thereon to be furnished for each employee, an identification tag or card, and metal checks of a different shape than the number checks, stamped with the names and sizes of the tools in stock. The workman is given an identification number stamped on a large metal tag, or perhaps a printed card which is arranged to display the identification number in prominent figures and should also be arranged so that his own signature will appear thereon. This identification tag or card must be shown when tools are called for.

CARD RECORD CHECK

Inside the tool room, a large board should be located at the most convenient point for the attendant's use and having a double row of hooks, the upper row to receive the ten checks bearing the workman's number, the lower row for the checks that are stamped with the names of the tools that the employee is using. Each tool bin must also have two hooks, one for the number check and the other for the check which is stamped with the name of the tool. In making requisition for a tool, let us take for instance a one-inch machine reamer, the workman will give his identification number which we will assume is number 50. The check room attendant will take one check numbered 50 from the board and hang it on the hook in the bin containing the one-inch machine reamer, remove the check marked one-inch machine reamer from the bin and hang it on the hook below the number check on the board and deliver the tool to the workman. Upon the tool being returned the procedure is reversed.

Under the plan known as the card record and check system, all tools that are likely to be a part of the workman's permanent outfit, such as oilcans, wrenches, files, brushes, etc., are recorded on a card which is filed at the time the tools are issued. Other tools that are to be used only for short periods are checked to him by one of the checking systems. Should the employee be discharged or resign he is expected to return the tools checked and also the tools charged to him on the record. In the event of tools on record being worn out, new ones are given out when the old ones are returned to the checkroom or credit given on the record if the tools are not replaced.

No metal checks are used in the disbursement of tools under the register plan with the exception of an identification tag. A register is used like the McCaskey or American, together with written memorandum slips made in duplicate. To all intents and purposes it is practically the same method as used in many grocery stores for charge purchases. Each check room attendant is furnished with a duplicate pad and as the individual employee receives tools he is given the original

slip with his number and a description of the tool he has received written thereon. The duplicate is filed under the employee's number in the register. When the tool is returned the original slip accompanies it and the original and duplicate are then destroyed, thus closing the transaction. This method has many advantages which are explained later.

Denominational checks may be used to good advantage on certain classes of tools and are useful especially when workmen are engaged on tool or repair work where large numbers of a few kinds of tools are to be used. These checks may be issued, of a different shape from the ordinary check, with the workman's number on the face, the reverse side being stamped 2, 3, 4 or 5 and may be used on such tools as bolts, straps and jackscrews. None of the checking systems are really suitable for pattern or wood shops, as a tool is generally used for only a short period and perhaps by the entire working force at least once during the day. All tools, however, including band saws, routers, saw files, templets and all other tools owned by the employer should be charged directly to the foreman of the department. To maintain an accurate record, breakages or renewals must be promptly recorded thereon. General tool accounts of this nature, to be kept accurate, should be checked four times a year and oftener if found necessary.

System for the Erecting Floor

If the erecting floor is a large department and situated at a distance from the machine shop checkroom, a separate room may be maintained to contain all tools that are used in the department and, while the tool disbursement expense may be increased, there will be greater efficiency in output. The time spent in walking back and forth to the distant check room is avoided as also is the probability that tools intended for erecting floor use may be in service in the machine shop. It requires very little nonproducing time of workman to pay for the services of the extra check room attendant and the congestion will naturally be less at the machine shop check room. This will materially assist the production of that department.

When a tool is broken in use, the employee should not be able to go to the check room and replace it without the knowledge of his foreman for the reason that by so doing the foreman would not have the opportunity to discover the cause of breakage and to take the necessary steps to avoid a repetition of the damage. "Tool breakage" reports should be carried by each foreman, should be filled out when the tool is to be replaced and the check room attendant instructed not to replace any broken or worn-out tool except upon receipt of the breakage report signed by the foreman. A simple form is shown in Fig. 1.

TOOL BREAKAGE Date ________

Workman ________________ Check No. ________

Name of Tool

Broken } Line thru one
Worn out }

Reason for breaking:-

________________ ________________
Tool Director Foreman

FIG. 1—TOOL BREAKAGE REPORT FORM

A daily or weekly report may then be made out for the superintendent by the tool director giving the tool breakage in condensed form. See Fig. 2. This report would be compiled from the tool breakage reports issued by the shop foreman and would enable the superintendent to keep in close touch with the amount of and reason for the breaking of tools.

STATEMENT OF TOOL BREAKAGE

Total ________ For week ending ____________ 191

Departments:	Mon	Tue	Wed	Th	Fri	Sat
Machine						
Assembling						
Foundry						
Tool						
Forge						
totals:						

____
Tool Director.

FIG. 2—WEEKLY REPORT ON TOOL BREAKAGE

When a workman resigns his position or is discharged, his tool account should be carefully scrutinized and steps taken to have all tools returned to the check room. A report should be made to the accounting or time keeping department certifying that the employee's account is clear or, should there be tools lost, notation should be made on the report to that effect. The form in Fig. 3 may be used.

Single Check System

The single check system, while the simplest and least costly in its operation, has many weak features that too often are allowed to pass unnoticed. A few simple instances are given: The check room attendant may place the workman's check on the wrong hook, he may accidentally knock the checks off the hooks and in replacing them be in doubt as to where they belong and he may perhaps replace them on the wrong hooks, the employee may return a certain tool in exchange for another and the attendant neglect to change the check from the first to the second tool. All these errors will occur every day in a check room of any size and especially in shops where the prevailing practice is to employ for tool checking young boys, whose sense of responsibility is usually lacking or only partly developed.

Often a tool checked to a workman is lost in the shop or perhaps it has been loaned by him to another employee and the transaction forgotten. Again it is not an uncommon practice for a workman to use a tool that is charged against another man without asking his permission and when the loss is discovered the workman against whom the tool is charged will quite frequently disclaim all knowledge of the tool to the attendant. After considerable argument, to avoid congestion at the tool room window while the discussion is going on and consequent delay in giving out tools to other workmen, the attendant will be forced to give the workman the benefit of the doubt because he fears that the check might have been misplaced in the check room through one of the errors above explained. In the same way the employee might break a tool and attempt to evade the

responsibility for the act by denying that he had received it.

Those readers who have not actually had charge of this branch of shop management, may doubt that these are common occurrences and will not believe that workmen will distort the facts to such an extent. The vast majority of people are honest and the workman who

CLEARANCE CARD

Name ____________________ No. ________

has returned all tools to the check department except

Date __________ ____________ Tool Director

FIG. 3—WORKMAN'S CLEARANCE CARD

will prevaricate about tools in all probability would not remove one cent's worth of material from the plant for his own use. The course of reasoning usually followed by him is that the tool is in the shop somewhere, he hasn't it anyway, and why should he have it charged up to him or receive a reprimand from his foreman if he can talk his way out of the difficulty. Considerable time may therefore be lost in finding checks when tools are returned to the checkroom and, in most cases, useful machine time is lost in addition to the labor.

When inventory is taken all tools must be accounted for and in a large plant this will necessitate that some tools be returned to the check room quite a considerable time before the employees leave work so that all will be able to turn in their tools by quitting time. As a consequence some workmen will be idle between the time that their equipment is called for and the regular quitting time of the shop. There will be similar loss of time on the day following inventory as it would be impossible to start every workman promptly, each man having to await his turn at the check room window for the necessary tools.

Inventory Difficulties

What has been said regarding the single check system is equally true of the double check system and, in addition, the extra work involved in handling two sets of checks must also be borne in mind. Furthermore, if twenty men were using the same size and kind of tool simultaneously then there would have to be twenty tools each with its check ready for use. An advantage over the single check system lies in the fact that each tool could be stamped or otherwise marked with a number and each name of tool check given a corresponding number so that identification of the tools that any workman might have would be complete. This system, however, would necessarily entail considerable work in its installation if a large number of workmen are to be furnished with tools and would be rather cumbersome in its execution.

The card record and check system combined is a step in advance of the plain check system but is open to the same objections as above except for the few tools that may be kept on the card record. The register system is an improvement over the previous methods as there are no metal checks whatever to be considered and while there is a slightly increased cost of operation in providing pads instead of metal checks the ultimate saving through the absolute knowledge of who is charged with each tool will more than balance the small cost of the pads. This system has none of the drawbacks that the check systems have for the simple reason that all transactions are duplicated in writing, one copy retained by the check room and the other by the workman receiving the tool. If he does not receive the tools listed to him, the workman would report it for correction at the time of receiving the tools and the charge slip.

Responsibility Settled

There cannot be any future argument regarding his responsibility for the tools. The employee is given a clip holder like that in Fig. 4 for filing all the charge slips that may be in his possession and it may either be hung on a nail by his machine or bench or kept in the tool box. He has the advantage of knowing exactly how his account stands at the check room simply by referring to his file, as all tools when returned to the check room are accompanied with the charge slip issued therewith. Upon the tools being returned to the check room, no time is lost in looking up checks as a glance at the charge slip and the tools will usually suffice to prove that the correct tools are returned and the workman is immediately released to return to his work of production. The tools are returned to their proper place at the check room attendant's convenience. Separate boxes may be placed at a convenient point to receive charge slips returned and charge slips issued and these also may be filed, or the duplicates, in the case of charge slips returned, removed from the register at the attendant's leisure. Objection may be made that it will require too much time for the attendant to write out the slips, but, as a matter of fact, it is a quicker operation for the competent attendant to write the charge slips than to take checks from the workman and hang them on a hook in the bin and then reverse these proceedings when the tools are returned. In addition, the shortening of the non-productive time of the employee through avoiding the necessity of waiting for checks is considerable in the aggregate.

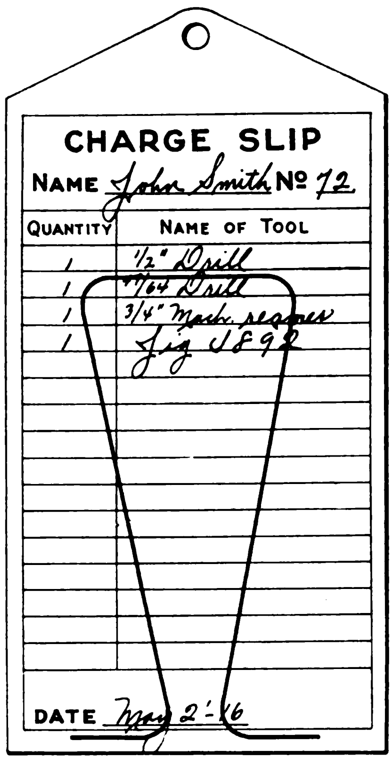


FIG. 4—WORKMAN'S CHARGE SLIP

It is customary in some plants to keep the check allotted to the workman on a board within the check room, the attendant taking the checks from the board when the tools are returned. In that event, the workman need not be detained after his tools are returned

to the check room while the attendant is looking up his checks although it might be preferable from the check room attendant's viewpoint were he to do so. It would be possible for the wrong tool to be turned in and the error undiscovered until after the workman had left the check room, thus making it necessary for the attendant to take the matter up for adjustment later.

If the double checking system is used then there would be the name-of-tool checks on the board, as previously explained, to correspond with the tools that the workman has received and the check room attendant in that case would only find it necessary to take these from the board and compare with the tools returned, placing the tools in their respective bins at his convenience.

In preparing for inventory under the register system, it is not necessary that tools be returned to the check system as the register system automatically provides a perpetual inventory of tools in use in the shop so that a clerk may take a copy of the tools listed in the register and count only the tools that are in storage. A saving may thus be made in workman's time at the inventory period and is an important consideration in favor of the register system. This method also provides adequately for the loan of equipment to other employees who may not have identification numbers such as office people or others outside of the works who may borrow tools. In addition, tools used by a department as a whole and not chargeable to individuals, as for instance, band saws in the pattern shop, may be recorded in the same manner.

The check room has not received the attention it has deserved until recent years but since scientific methods have been applied to shop management the importance of this department has been more fully recognized and its operation more systematically developed. The writer, in looking ahead, makes the suggestion that in the future the ideal check room will consist merely of a private storeroom from which tools will be delivered to groups of machines by an overhead carrier system and returned to the check room in the same way. The workman will be charged with the tools by a register system similar in every detail to the cash register used in all stores. There will be no occasion for the workman to leave his machine, neither will it be necessary for the tool attendant to leave the check room. A check room so managed that no workman wastes valuable time waiting for tools is indeed rather hard to imagine, but so were some of the recent developments in management only a few years ago, and while the writer is aware that the ideal check room is hard to develop, it must be admitted that the requisite conditions are not impossible.

Machine Shop Bulls—III

By Joe V. Romig

Tim Doolin had bulled his job again, a shaft this time, and was busily engaged in trying hard to dope out a way of getting out of this mean scrape. He knew well that it meant the "grand bounce" for him if Jennison, his foreman, would find out, and so he schemed how best to hide or dispose of the bulled shaft. Tim was one of those who bulled frequently, through inattention to his work, and was known by all to be on his last chance. To hide, and where, were his thoughts as he threw off the apparently finished shaft and placed another one between the centers.

After the midnight lunch hour, things usually quieted down a bit, and it was during these hours that Jennison, the boss, usually took his wee bit of a nap. Choosing this opportune time, Tim shouldered the bulled shaft and disappeared through the side door of the shop. Crossing over twenty or more tracks of the mill's railroad yard brought him to the river bank, down which he disappeared, shaft and all. Reaching the river's edge he scooped out a shallow ditch with an old tin can and socked the shaft into its grave with a vengeance. Covering it lightly he went back to his work, thinking and smiling about how good a job he had made out of a bad one.

While still smiling to himself, at 3 G.M. a heavy hand was held on his shoulder and there stood Murphy, the head detective.

"Say bo, who is your foreman?" he inquired of the frightened Tim. "Go get him quick," he continued, "he is wanted out here in the yard, right away."

Not wishing to cause suspicion or get in wrong with the copper, Tim went and hunted up Jennison and brought him to the still waiting Murphy, chief of the detective staff.

Jennison was told that he and his man here, were wanted to attend an inquest over on the river bank, and slipping quietly over to the now frightened Tim, Murphy inquired whether he would go over with or without the cuffs. Tim leaped into the lead of the party, taking them straight over the tracks to his dead and buried bull.

He was told to dig, and out came the shaft, which he was ordered to carry back again into the shop. Murphy then turned to Jennison, and said, "I have now done my duty, you do yours," and walked away, knowing that justice would be meted out accordingly.

After a few moments of reflection, Jennison turned to poor Tim and said, "Tim, firing is too good for a guy like you; I'll keep you on, but from now on and forever, you will be called the 'undertaker' of machine shop No. 8." And the name stuck, for even to this day he is known and called by his nickname, Undertaker.

"Three-Handed Workers"

By A. W. Brown

Some one, let us say Sydney Smith, who gets credit long after his death for most good things that we can not exactly place, has said that some persons have three hands: "two like you and me, and *a little behind hand!*"

Every badly managed plant has some of these. They cause loss not only by doing less work than they are paid for, but by keeping others waiting for supplies, instruction or service; also by their bad example.

A good remedy is to deduct from the pay envelope or the check a sum representing the late minutes or hours, and paying it into an employees' sick fund or amusement "kitty."

It is disagreeable for most employers to drive the lesson of punctuality home through the purse of a worker.

Being prompt is almost entirely a matter of habit and the rut of lateness is very likely to spread beyond a man's time at the shop. Amputated at work, "the little behind hand" will be lost in his daily life.

FIG. 1—A GENERAL SHOP VIEW

A Machine Shop Which Moved Out of the City

Increasing Business Made Expansion Necessary—A New Shop Nine Miles Out of Baltimore—Layout of Shop and Arrangement of Departments

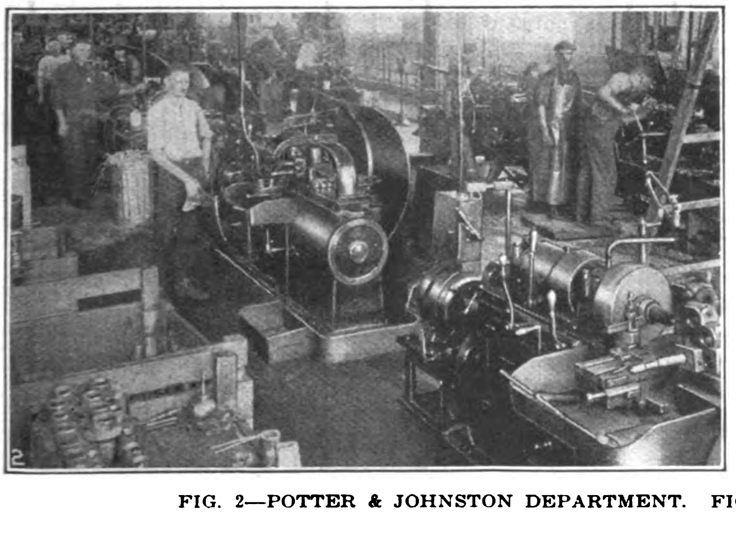
SPECIAL CORRESPONDENCE

THERE has been talk of decentralization in machine building, both on account of the difficulty of securing additional room in cities and the advantages of light, air and freedom from transportation difficulties in some cases. Therefore, when the need for expansion became urgent for them, the Black & Decker Manufacturing Co. found a site at Towson Heights. about 9 miles out of Baltimore, Md. The company there erected a new plant and the story of growth, which made this expansion necessary, is interesting.

Beginning back in September, 1910, Messrs. Black & Decker began business as tool and jig designers, builders of special machinery and also of a few electric tools. According to Mr. Black, in order to raise capital for a start, he sold his automobile for $600 and Mr. Decker raised a like amount from some similar source. Things grew very satisfactorily until 1914 when it was decided that as special machinery depended too much on the personality of the principals, they would specialize on some staple product. They settled on electric drills and air compressors.

The shop shown herewith was built in the fall of 1919 and ready for use early in 1920. Some of its features, both of construction and equipment, are worth consideration by others who are contemplating getting out of the city and away from the crowds. The building is a high, single story one with a monitor in the center. It is 13 ft. in the clear with 5 ft. 5 in. more to the roof. The monitor is something over 5 ft. more. A general idea of the construction, as well as the large window area, can be had from Figs. 1 and 2.

In Fig. 1 is shown a general shop view with the assembly in the foreground. This shows the location of the steam radiators up in the girders and the distribution of light all over the shop. The illustration, Fig. 2, shows mostly Potter & Johnston machines, with their



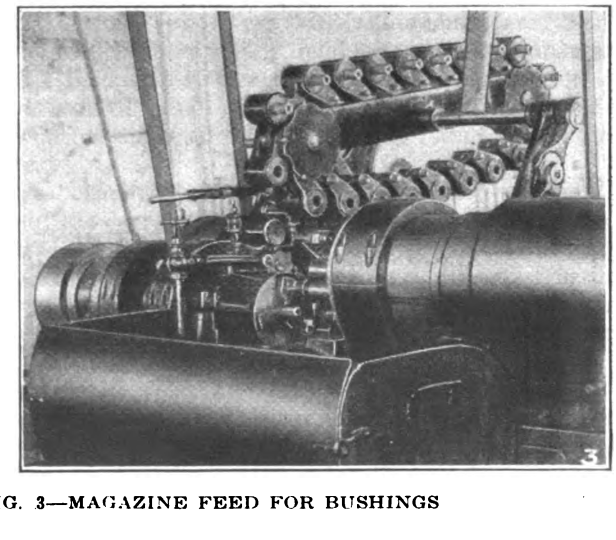
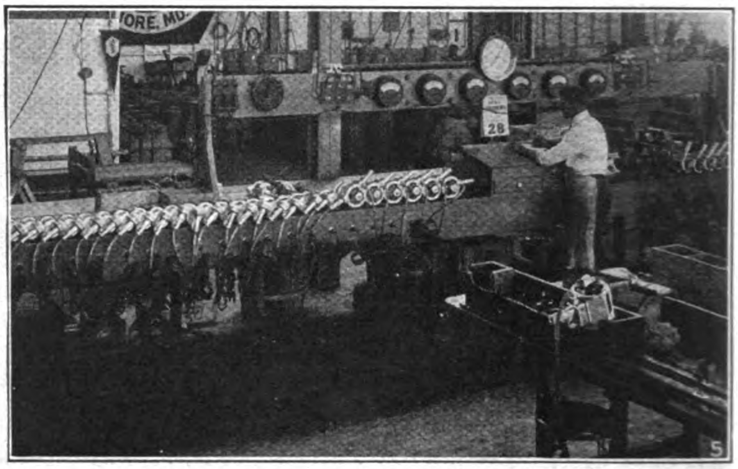
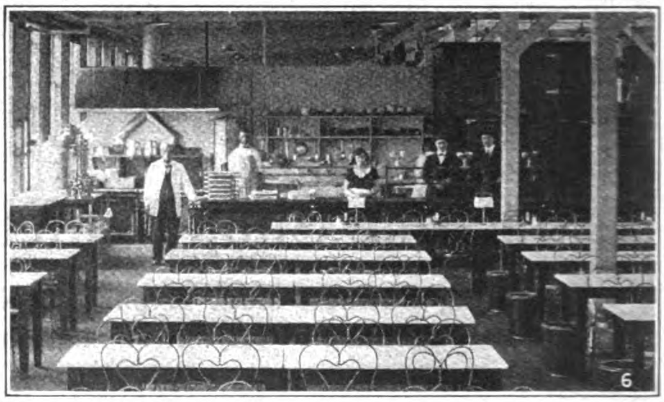


FIG. 2—POTTER & JOHNSTON DEPARTMENT. FIG. 3—MAGAZINE FEED FOR BUSHINGS





curved oil guards, the types of bins and benches used and the kind of step ladder used for overhead work. An interesting detail of manufacture is shown in Fig. 3, where a Cleveland automatic with magazine attachment is used to handle cast bushings. Casting the bushings eliminated the use of solid rod as stock, with the resultant saving in metal.

Part of another assembly department is shown in Fig. 4, while the testing bench for drills and grinders is shown in Fig. 5. Each unit being tested is plugged into a light circuit the same as in practice. The instruments show current consumption at all times. Being away from city restaurants, an eating place became a necessity, hence the cafeteria shown in Fig. 6.

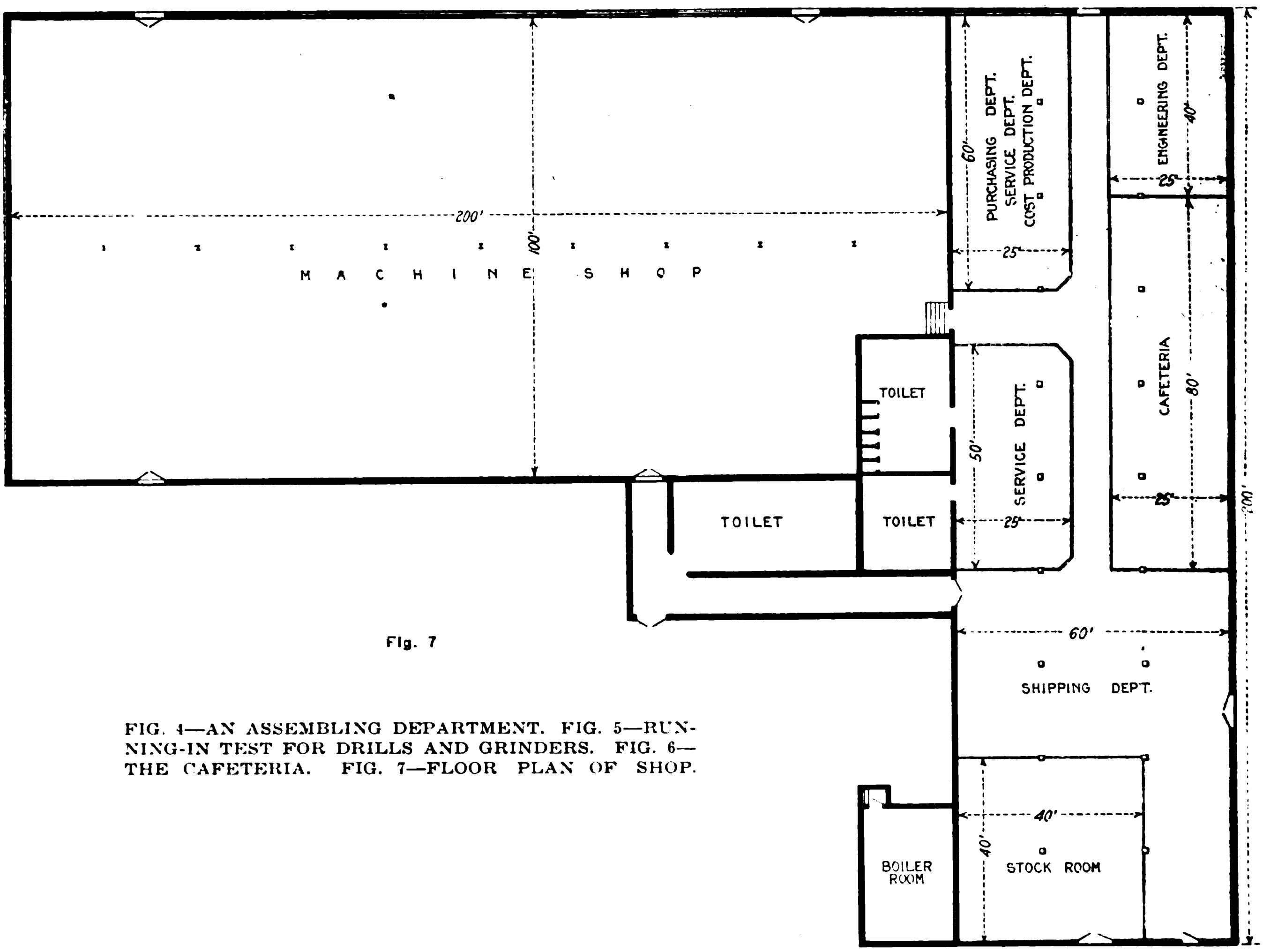


FIG. 4—AN ASSEMBLING DEPARTMENT. FIG. 5—RUNNING-IN TEST FOR DRILLS AND GRINDERS. FIG. 6—THE CAFETERIA. FIG. 7—FLOOR PLAN OF SHOP.

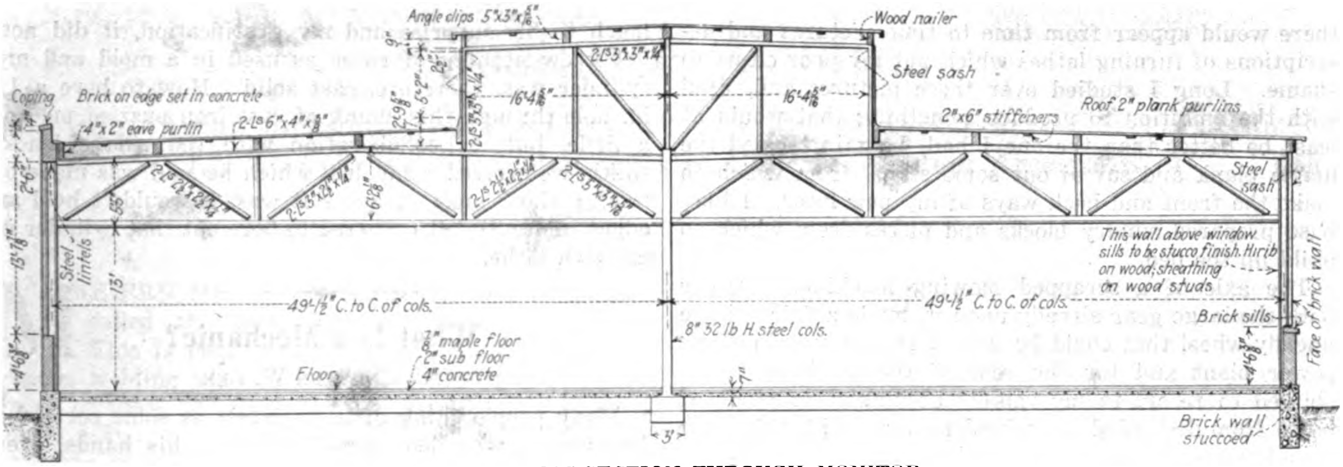


FIG. 8—CROSS-SECTION THROUGH MONITOR

The plan of the shop is shown in Fig. 7, while Fig. 8 is a cross-section giving the principal dimensions to anyone who has need of a similar shop. The exact floor layout can, of course, be altered to suit conditions but the general construction will be found serviceable in many places. This move into the country also involved the building of a number of houses along very attractive lines. Anyone interested can secure information as to these houses as well as further details of the shop buildings and their equipment.

Learning the Trade Forty Years Ago

By W. S. Davenport

(The first of four articles)

Boys of the present day who are mechanically inclined and who live within easy reach of the modern vocational and trade schools, with their able instructors and complement of fine machinery upon which to work, little realize the difficulties that beset the boys of 40 years ago who wished to "learn the machinist's trade." When I was a boy and lived on a farm among the hills of old New England I wanted to run machinery. Though at that time the term "machinist" was unknown to me, I knew the kind of work I wanted to do and the rare opportunities that came to me, perhaps once or twice in a long year, to visit the machine shop in a neighboring town were wonderful treats indeed. Well do I remember saying, one Sunday morning on my way to church, that I wanted to "work in iron," a desire that greatly perturbed my good mother, who had pictured me a farmer like my father and most of her acquaintances.

In the summer I was kept pretty busy during my hours away from school, attending to the many minor duties about the farm. Thus, I had little chance to indulge my craving for machinery, but with the coming of autumn and the harvest time there came also the traveling threshing machine with its crew and I was in my glory. This machine was driven by an old-fashioned horsepower in which a pair of horses were made to walk continually up an interminable hill while the "ground" beneath their feet was as constantly sliding backward.

Sawing Wood and Threshing Grain by Horsepower

Later in the season, when it was time to prepare the winter's stock of firewood, the threshing machine was replaced by the "dragsaw," a wonderful device operated by a system of gears and cranks and driven by the same horsepower. Never, thought I, could anything be more marvelous than the way the wheels turned and the reciprocating saw was pushed rapidly back and forth, never could logs be severed more quickly.

A crank churn, with gears and wheels to make the floats revolve, was of absorbing interest and to me a mowing machine was about the finest piece of mechanism that could possibly be evolved.

My father, like all New England farmers, was "handy with tools" and possessed an assortment of saws, chisels, planes and other implements of the carpenter's trade in which I early became interested. At the age of ten years, I could split a log and prepare the pieces with plane and saw and chisel to make picture frames and other simple objects. For this work I received considerable commendation and was told that I would make a good carpenter, if I would stick to it.

My First Lathe

My grandfather, who lived in a neighboring town, had a wood turning lathe that he had built and rigged up to be driven by a belt from the grindstone, the hired man at the crank of the grindstone supplying the energy. I could not command the services of a hired man but, inspired by the example of my grandfather, I set out to construct a lathe of my own.

The shaft of an old churn furnished the spindle for this lathe, while odds and ends from broken down or worn out farm machines, pieced out with blocks and strips of hard wood, provided the remainder. For a power plant a discarded grindstone was seized upon and to this I fitted a square shaft made by rip-sawing (by hand) a hard maple plank, 2 in. thick, and by whittling the ends of the resulting square strip round with a jack-knife.

For "bearings" I bored holes with an augur in the legs of the carpenter's bench and to one end of the shaft I fitted an unique pedal motion, a duplicate of which has never been seen before or since its construction. Notwithstanding the crudeness of the device, it could be made to run and, with a good deal of exertion and perspiration, I was actually able to accomplish some creditable wood turning upon it.

Like many another farmer's boy I had the *Youth's Companion* and in the premium lists of that publication

there would appear from time to time pictures and descriptions of turning lathes which put my poor effort to shame. Long I studied over these pictures and, fired with the ambition to produce something that would at least be better than the one I had, I again tackled the maple plank and sawed out some strips from which to make the front and back ways of my new lathe. I likewise prepared sundry blocks and pieces from which to build up the bed.

The axle of a scrapped mowing machine, together with the large gear already upon it, made a fair spindle and fly-wheel that could be driven from my grindstone power plant and for the rest of the machine I was obliged to resort to my rapidly accumulating stock of parts from discarded farm implements. With this lathe I made some patterns and had them cast in the foundry of the shop in the adjoining town so that I was able to build a jig saw that was the envy of all the boys around.

My First Acquaintance With Twist Drills

I could devote only odd moments of leisure to my shop. I was a long time in reaching this stage and, in the meantime, I had graduated from the *Youth's Companion* to the *Scientific American*. In this periodical, I had seen the advertisements of the Morse Twist Drill & Machine Co., and had painstakingly studied over them until I had acquired a considerable technical knowledge of drill gage sizes, machine screws and threads.

Though pennies were to me more scarce than are dollars to many of the boys of now-a-days I carefully saved up enough money to send for a ⅛ in. twist drill, which I received with great joy. It was a most wonderful tool and attracted a great deal of attention as it was probably the only one of its kind in a radius of 20 miles from my home. The only kind of drill that had hitherto been known thereabouts was the flat drill, forged by the country blacksmiths to somewhere near the desired size.

With the product of my jig-saw I traded with neighboring farmers for broken down mowing machines, hay cutters, sewing machines, etc., in fact anything that had gears and wheels in it, until I had collected quite a treasure of what had once been machinery. The cash value of this junk was probably not worth considering but to me it represented vast wealth, as from it I could now build other machines and thus acquire experience and understanding of my chosen trade.

I Build a Steam Engine

Among the advertisements to be found in the *Scientific American* was one by Goodnow & Wightman of Boston, who would, for a consideration, undertake to supply amateur mechanics with a set of castings and other material from which to build a model steam engine. Seized with an intense desire to be the constructor of a steam engine that would really go, but too poor financially to purchase the bill of material, I eagerly studied these advertisements, pored over the pictures, digested all the reading matter that pertained to them, and decided to build an engine from my own junk pile.

With much labor and painstaking care, I proceeded to make the patterns for a slide valve engine of 1⅜ in. bore by 2 in. stroke, including a fly-wheel with straight arms, for I did not like the looks of the crooked ones that were then thought necessary to avoid breakage in shrinkage. The molder, to whom I entrusted this pattern for casting, assured me that it would break but, much to his surprise and my gratification, it did not.

I knew nothing of cores as used in a mold and my cylinder was, therefore, cast solid. How to bore a 1⅜ in. hole through this chunk of cast iron puzzled me not a little, but, by collaboration with the village blacksmith, we evolved a flat drill which he said was made of "sleigh shoe" steel (I guess it was, it wouldn't hold an edge) and with it I prepared to bore out that cylinder in my own lathe.

What Is a Mechanic?

By Charles W. Lee

Many people think of a mechanic as some sort of a low person who does something with his hands, even including digging the tradional post holes, made famous and immortal by good old "Chordal"; and of an engineer as some other sort of a low person who starts and stops a steam engine. From this point of view a mechanical engineer must be two low persons rolled into one, and therefore twice as disreputable as either alone.

This objectionable state of mind is well illustrated by the remark made by a beautiful lady at Old Point Comfort during a meeting there of the American Society of Mechanical Engineers. In answer to her inquiry she was told that the party was "The Mechanical Engineers."

"Mechanical Engineers! But they are quite respectable looking!"

Therefore the following definitions are proposed:

Mechanic: one who understands mechanical art.

Mechanical Engineer: one who solves mechanical problems.

It is true that the popular definition of "mechanic" has dictionary authority, but so have some other words which have more than one meaning, and even exactly opposite meanings, which makes confusion. Yet some other words have outgrown the dictionary, and why should not this one?

There should be a distinction between one who merely manipulates something with his hands, and another who knows what his hands are doing and why they are doing it. Manual dexterity should not be confused with mechanical knowledge any more than mechanical knowledge with scientific knowledge. There is nothing at all in this that is intended to belittle manual dexterity.

Science, which dreams and discovers; mechanical art, which applies science; and manual dexterity which finally makes it possible for the dreams of science to be realized, are all factors, and therefore equally necessary to the perfect whole—and accordingly equally honorable.

Friendly Competition

By A. W. Brown

While in some activities of life, competition is too sharp, a certain amount is good not merely for the community (which may be the shop, the nation, or the world) but for the competitors. Many a man has "found himself" only as the result of friendly competition with the man at his elbow, or in the shop across the street, or on the other side of the ocean. He discovers in himself and in things new sources of power and new methods of utilizing the old ones, and emerges from each contest more able and ready for the next.

Resistance Welding

The First Article—Methods of Welding—When a Flux Is Necessary—Current Required for Electric Welding—Principles of Electric Welding Apparatus

By A. L. De LEEUW
Consulting Editor, *American Machinist*

MODERN METHODS of welding have often been called the long-waited-for "putting-on" tool. This is particularly true of arc welding, autogenous welding and the Goldschmidt thermit process. In all of these processes metal is added to an existing piece, either to fill up a crack, to enlarge the piece at some point where the forging or casting made it too small or to form a bridge of metal joining two pieces. None of them is true welding. Resistance welding, on the other hand, does exactly what is accomplished by the blacksmith when he welds one piece to another. In books, 30 to 40 years old, one may find the statement that one of the qualities of iron is that it is not weldable. Brass or bronze or pure copper were not considered weldable.

What was meant by "weldable" was that certain materials could be brought, by heating, to a state of plasticity which made it possible to join them by pressure in much the same way that we can make two softened pieces of beeswax adhere to each other. No reasonable amount of pressure will join these pieces of wax when they are at the temperature of ice but as we gradually warm them they become softer until finally it is possible to unite them by slight pressure. They have become one in all respects. If we should try to separate them we would merely succeed in pulling the piece of wax apart and the probability would be that the break would not be where the joint was.

Conditions of Welding

Any two materials which can be brought to this plastic state can be welded. The reason why wrought iron was weldable was that it could be brought to this plastic state. As a matter of fact, practically all metals can be brought to such a plastic state and if we wish to understand the possibilities and also the difficulties of resistance welding, we should first look into the question as to why one material can be welded so much more easily than another when both can be brought to the plastic state required for the operation.

In Fig. 1, a diagram is shown in which the temperatures are laid out on the horizontal scale. Going from

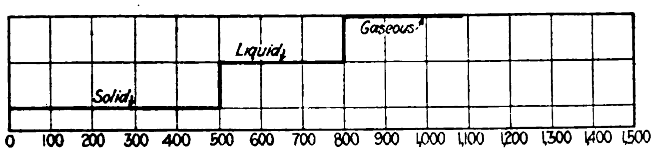


FIG. 1—DIAGRAM ILLUSTRATING RELATIONS OF TEMPERATURE AND CONDITION OF A METAL

left to right the temperature increases. Three stages are shown, one representing the solid state of the material, the second its fluid state and the third the point at which it evaporates or boils. Fig. 1 is entirely imaginary. We see that from 0 to 500 the material is in the solid state, at 500 it suddenly changes over to the liquid state, at 800 it suddenly changes to gas. Such sudden changes do not occur in reality.

Fig. 2 gives the diagram of the changes which take place in reality, though the figures are again imaginary. From 0 to 500 the metal remains in the solid state. From 500 to 1,000 it gradually changes, becomes less and less hard or, if we may say so, less solid until at 1,000 deg. it is completely liquid. It remains liquid from 1,000 to 1,300 when it begins to evaporate.

The range between 500 and 1,000 is the range of temperature with which we are mostly concerned when doing resistance welding. It is the range within which

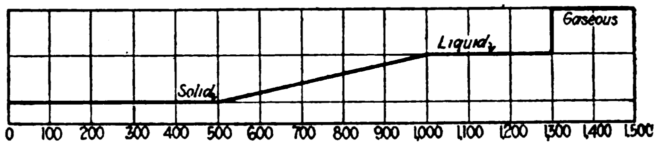


FIG. 2—DIAGRAM ILLUSTRATING THE GRADUAL CHANGING FROM SOLID TO LIQUID WITH RISING TEMPERATURE

the material is in the plastic state. It is very little plastic at 500, almost liquid near 1,000, and there are various degrees of plasticity between these two points. If we should have a material which is really in the plastic state between such wide limits as our diagram represents, that is between 500 and 1,000 deg., it would be very simple to weld two pieces together because even the crudest way of heating the piece would give us a sufficient time limit between the moments when it is entirely solid and when it is entirely liquid.

If, on the other hand, we should have a material which is entirely solid at 500 deg. and entirely liquid at 510 deg. it would be extremely difficult to weld two pieces together because we would have to catch the exact temperature between very narrow limits and thus work so exceedingly rapidly that the material would have no time to cool before the welding became complete. This is the reason why wrought iron and steel can easily be welded and why it is so difficult to weld copper, brass and various other materials.

The Old Method

When the blacksmith wanted to weld two pieces of wrought iron or steel together he would heat them to a point where the sparks began to fly, which was, to him, an indication that the metal was soft enough and far enough advanced in the plastic state, to permit the two pieces being joined by relatively light pressure, such pressure as could be given by hitting it with a hammer. Before actually applying this pressure he would put a flux on one of the pieces for the purpose of removing any oxide or other foreign material. He knew it was necessary that the pure, clean metallic surfaces should come in contact with each other. The flux was some material which, combining with these impurities, would become a liquid which could easily be squeezed out from between the two pieces to be welded.

The operations in resistance welding are very much the same as those of the blacksmith. In order to stay

as close as possible to the old process of the blacksmith, we will confine ourselves for the present to a form of resistance welding which is called "slow butt welding." In this process two pieces of metal are joined end to end. We will see later that there are also other methods of resistance welding. In the slow butt welding process the two pieces to be joined are heated until the plastic state is reached and then pressure is applied, joining them together. There is no flux used and the question of removing the oxides and other impurities must be solved some other way. The manner in which this is done is to melt off part of the material so that all the impurities will be removed with this molten metal and then to squeeze the two pieces together before the air can reach the new surfaces.

Resistance Welding

There are then, two things which we must accomplish if we wish to weld successfully. One is to bring the material to the proper heat and the other is to apply the pressure. The manner in which we obtain the proper heat for welding is by sending a current of electricity through the pieces. We are all familiar with the fact that a body is heated up by the passage of an electric current. Incandescent lights are based on this principle. The amount of heat developed is in direct proportion to the amount of power we send through the circuit. If for instance, we have a dynamo developing 100 kw., all of which is consumed by a system of wiring and a number of incandescent lamps, we know that there is enough heat developed in this system to absorb all of this 100 kw. Part of this amount may be used in the lamps themselves and another part in heating the wiring. If we have a great length of circuit, we can use only relatively few lamps because much of the power is consumed in the wiring itself. If, on the other hand, the circuit is short, we can have more lamps.

The amount of current which flows through a circuit depends on two items, the voltage supplied by the generator, battery or transformer and the resistance of the circuit. If we have a generator or battery or transformer which supplies current at 110 volts and which is so regulated that it will always deliver this voltage regardless of other conditions, then the amount of current will depend directly on the resistance. If, for instance, we had a 1,000-kw. generator furnishing current at 110 volts and if we had a short line with only two 50-watt lamps in it, the amount of current delivered by this generator would be only 100 watts or $\frac{1}{10}$ kw. notwithstanding the fact that it could deliver 1,000 kw.

Amount of Current

In most applications of electricity, with which we are familiar, voltages and resistances are rather high and the amount of current rather low. In resistance welding the opposite is the case. Here the resistance is very low and so is the voltage, while the amount of current is very high.

Various pieces of work may require various amounts of current but their resistance may be such that they would receive an entirely different amount from what they need if the voltage were always the same. In order then, to be able to furnish as much current as is required and no more nor less it is necessary to have a variable voltage. The simplest way of obtaining such variable voltage is by the use of a transformer with an alternating current circuit. Without going into reasons why a transformer is able to do so, we may say here that this piece of apparatus can give any voltage required when the current which leads into it has one fixed voltage. For instance, we can lead a 440-volt current into a transformer and take from it a current at 220, 110, 55, or even 1 volt. Moreover, we might have gone the other way and taken the current from the machine at 880 or 2,200 volts.

The general construction of such a transformer is two sets of copper windings around one and the same iron core. The current coming from the generator is led in around the iron core and out again back to the generator and is known as the primary current. The secondary current is that current which we take from the apparatus. The winding for the secondary current has more or less turns around the core than that for the primary one, according to whether we wish to step the voltage up or down. If the primary winding has 10 turns around the core and the secondary winding has 100 turns, then the secondary voltage will be ten times as great as the primary. If, on the other hand, the primary winding has more turns than the secondary, we will have a reduced voltage. Suppose we should have 10 windings on the secondary current and suppose that this will give us 10 volts. Then, if we should tap our wiring not at the end of the 10th winding but the end of the 9th we would get only 9 volts and if we should tap it at the end of the 2nd winding we would get only 2 volts. This shows how it is possible to get any voltage from an alternating current circuit.

Making the Contact

The resistance welding machine consists of a transformer with means to tap the secondary circuit at various points and so obtain varying voltages. As the amount of current will be very great the secondary winding must be made of heavy copper wire or bars. As the voltage of this secondary winding is very low all the joints of the wiring must be made perfect so as not to have a loss of voltage by imperfect contact.

The work to be heated is held between two copper electrodes. As these electrodes must be shaped to suit conditions and shape of the work, they are generally called dies. There are then, two pairs of dies, each pair gripping one of the pieces to be welded together.

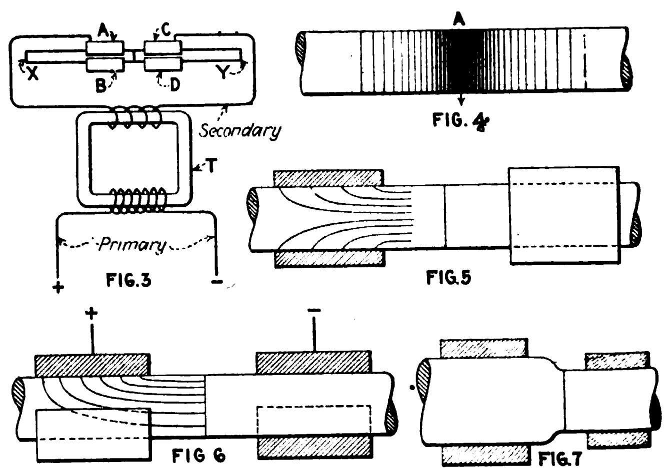


FIG. 3—DIAGRAM OF THE ESSENTIAL ELEMENTS OF A RESISTANCE WELDING MACHINE. FIG. 4—DIAGRAM SHOWING JOINT DISTRIBUTION OF HEAT WHEN TWO PIECES ARE BROUGHT TOGETHER IN WELDING MACHINE. FIG. 5—DIAGRAM SHOWING PATH OF CURRENT WHEN PIECES ARE SURROUNDED BY DIES. FIG. 6—DIAGRAM SHOWING UNEQUAL RESISTANCE WITH ONE FLAT AND ONE CURVED DIE. FIG. 7—TWO PIECES OF UNEQUAL DIAMETERS HELD IN WELDING MACHINE.

One pair of dies is stationary, the other can be moved by means of a lever or some other mechanism. In the case of very heavy welding, hydraulic cylinders are used to supply the required pressure.

When a piece of work is gripped in each of the two pairs of dies and the switch is thrown in so as to permit the current to flow through, nothing will happen until the two pieces of work are brought together because the circuit is not closed. As soon as the two pieces of work touch, this circuit is complete and the current will flow through, heating the pieces. It might be asked whether the entire apparatus is not going to be heated and where the greatest heat will be developed.

Elements of Machine

In Fig. 3 the elements of a resistance welding machine are shown in diagrammatic form. T is the transformer core with its primary and secondary windings; A and B is one set of dies; C and D the other set; the two pieces to be welded are marked X and Y. They are shown here to be in contact with each other so that the current will flow from the transformer through A, through X, then through Y and C and back to the transformer. In reality the windings are not wires as shown in the diagram but heavy cables, or, where this wiring is attached to the movable parts of the machine it may be a set of copper leaves which will permit their movement. In either case the resistance of the wiring is very small. In fact, the total resistance of the circuit is small so that the amount of current which will flow through it is very great, notwithstanding that the voltage used is low.

When the current flows through this system, the two pieces X and Y will be heated at the joint and the question naturally arises why this should be so. To the man who is not daily considering electrical problems it may be confusing to hear one moment that the amount of current is very great because the resistance is low and the next moment that the greatest amount of heat is developed at the joint because that is where the resistance is greatest. The matter is very simple, however, if one gives it a minute's thought. The amount of current flowing through the entire system is great because the resistance of this entire system is small. If the voltage is indicated by V, the resistance by R and the current by C, the relation $C = \frac{V}{R}$ exists. If once the voltage is fixed, the amount of current will depend directly on the amount of resistance so that with the two pieces in place a certain amount of current will flow through the system, depending on the total amount of resistance of the wiring, the dies and the pieces to be welded.

Theory of Heating

If, in any circuit, there is a certain amount of current flowing, then this current will heat up all parts of the system but not, necessarily, equally. We know that the amount of power consumed anywhere in the system equals the product of the voltage and the amount of current. Power $= CV$, and as $V = CR$, we find that the amount of power consumed in any part of the system is C^2R. Now the amount of current, that is C, is fixed by the total resistance of the system and we see that the greatest amount of power is consumed and therefore the greatest amount of heat is developed at that part of the system where R is the greatest. Come to consider it, we really were familiar with this fact. The reason why the filament of the incandescent lamp is heated, whereas the insulated wire leading up to it remains cool, is simply that the resistance of this filament is many times that of the copper wire.

Knowing these elementary facts, we can now readily understand why the heating will start at the joint of the two pieces X and Y. This joint is imperfect. Even though we may press Y against X the contact between the two pieces can never give the same conductivity as that of a solid piece of material. It is at this joint then that the heating of the system starts. The heating continues and spreads backward, somewhat as illustrated in the diagram, Fig. 4, with the joint of two pieces as shown at A and with the amount of heat developed as represented by heavier and lighter lines. It will be noticed that the pieces are gripped in copper dies. These dies have a broad contact with the pieces, have a large exposed area and, as a rule, are water cooled so that the heat of the pieces is rapidly carried off by them.

Figure 4 shows the two pieces bearing squarely against each other so that the resistance is the same at any point of the cross-section. As a consequence, the same amount of heat will be developed at all points of the joint. If the pieces were not square or if their axes were making an angle with each other there would be a pointed contact, or at least, a contact over very limited surfaces. The resistance would be maximum at that point and the heating would start there. Unless we do something to counteract this effect, the metal at that point will melt. Such conditions must be avoided.

Ideal Welding Conditions

With heating, such as shown in Fig. 4, we have ideal conditions for the making of a perfect weld. The metal at the joint will gradually become hot enough to melt. Immediately behind this zone there will be a layer of metal close to the melting point, but still solid. Further back there is metal which is perhaps not plastic enough to be suitable for welding but soft enough to be easily compressed. Still further back the metal may be hot but hard enough so that it cannot be deformed by the pressure brought to bear when we make the weld.

The relative thickness of these layers is affected by quite a variety of things. For instance, if the dies have a broad grip on the piece and are water cooled, the heat will be carried off so rapidly that only a very short piece of the metal is heated. Even at that, the heating depends on the amount of projection of the piece beyond the die. If a long piece should be projecting, the heat would have to traverse this long piece before it would reach the die so that there would be a large amount of metal in the molten or plastic state. This would be still further aggravated if the projecting piece were of small diameter because the resistance would increase and therefore the amount of heat developed and the rapidity with which the heat can be carried off would be reduced because the cross-section along which the heat would have to flow is very small.

The manner is which the piece is gripped by the dies is also a factor determining in what manner the piece will be heated. In Fig. 5, the pieces are shown as held in solid copper bushings which, by the way, is not the way we would do it in practice. There is here a perfect, even grip all around the piece and as a result the current flows in a perfectly even manner from the dies through the cross-section of the piece toward the joint. In Fig. 6, another extreme is shown. In this case there

is a flat top die, making a line contact with the piece, while the bottom die reaches about half way around the piece. Here the current, which enters the top dic only, must flow along a path of varying length to reach the various different points of the joint. As the lengths of these various paths are unequal there is an unequal resistance to overcome so that, in this case, we would find that the pieces are heated more at the top than at the bottom, notwithstanding that they bear squarely against each other.

There is still another item to be considered. The resistance of the material changes as it is being heated. It becomes greater. If the pieces are heated at one point, due to some defect in the bearing or distribution of the current, the resistance at that point will be increased. Consequently, the heating effect at that point will be still further increased.

If pieces of uneven diameter should be pressed against each other, see Fig. 7, the following will occur: The heat developed at the joint has, of course, a tendency to warm up both sides of metal but this heat will be carried away on the left side by a much larger section and larger dies, both pieces of steel and die having a larger radiating surface. As a result the metal will all melt away on the right side, whereas that on the left side will remain relatively cool.

Resistance Altered by Heat

Assembling the various points discussed so far, we see that the heat developed depends, in the first place, on the voltage; in the second place, on the resistance of the entire circuit; in the third place, on the nature of the contact between dies and pieces; in the fourth place, on the way in which the dies are cooled; in the fifth place, on the manner in which the two pieces make contact with each other; in the sixth place, on the amount of projection beyond the die, and finally, on the cross-sections.

It would seem as if, with so many variable elements, it would be extremely difficult to get conditions right for the making of a weld but this is not at all the case. Due to the fact that there is such a wide temperature range within which welding can be made, the fact that there are so many elements helps us in many cases for if conditions are unfavorable in one respect there are several elements within our control which we can modify so as to make conditions right in some other respect.

We will now see how the foregoing can be applied to the making of welds. A great many names are given to various combinations of pieces to be welded and to the various processes to effect such welds. The main processes are these:

Slow butt welding (sometimes called "up-set" welding).
Flash butt welding.
Spot welding.
Seam welding.

Feed Pressure of a Twist Drill

By R. Poliakoff

In the Sept. 28 issue of the *American Machinist*, p. 480, A. L. De Leeuw, in his article on "Methods of Machine Tool Design," while speaking about feed pressures says, "In a drill press the feed pressure depends on two items, both of which are rather undetermined at the present time. Using a twist drill, we find two elements requiring feed pressure. One is the penetration of the lip into the material, the other the penetration of the bridge or web between the lips. This latter item is entirely undetermined and may be very great. The first item resembles to a certain extent the pressure required to feed a lathe tool into the work."

Extensive experiments have been made in 1907 by the writer and Mr. Dempster Smith of the Manchester School of Technology in Manchester, England, for the very purpose of determining the feed pressures of a *high speed* twist drill when working on different metals under different conditions and also the two items of same—one due to the lips and the other due to the web. These experiments were made the subject of an extensive paper read before the Institution of Mechanical Engineers in March, 1909 and, while it would be out of place to go into the details of these tests and all the results of the same, those interested may consult the "Proceedings of the Institution of Mechanical Engineers," London, 1909, pp. 315-415.

I may mention here that those tests have shown that the web is accountable for about 20 per cent of the total end or feed thrust. To be more specific, it was found that in case of soft cast iron, the pressure P can be expressed by the equation

$$P = 35{,}500\ d^{0.7}\ t^{0.75}$$

If we eliminate the effect of the web, the pressure would be

$$P = 12{,}600\ d^{0.7}\ t^{0.6}$$

or about 25 per cent less. This difference increases with the feed, (d is the diameter of the drill and t the feed).

In case of medium steel, respective equations are

$$P = 35{,}500\ d^{0.7}\ t^{0.6}$$
$$P = 27{,}000\ d^{0.73}\ t^{0.6}$$

In this case, the thrust due to the web is about 21 per cent of the whole drill.

Unnecessary Interruptions

By Frank V. Faulhaber

"This is what I call a machine shop of half-way jobs," is the way an employee recently explained it, after he had been taken away from one job, uncompleted, to start another. "There are so many things to do here that you don't often have the time to finish a given job from beginning to end."

Where this practice is existent the men in charge do not realize how much valuable time is being wasted in the process. For one thing, there is always the time in between two different jobs, however little, that is lost. And we have noticed in certain machine shops where it is customary to take a man from one job and start him to work completing another, that much unnecessary additional work is involved, since the second man must find out what the first one had been doing, entailing the asking of questions and other details, which would not have been necessary had the first man finished his task.

In this connection, one executive recently gave the advice: "Never take a man away from a job unfinished, if you can possibly avoid it, and do not interrupt him during a job. If you have something to tell him, wait until the job is done, otherwise you are taking his mind away from his work."

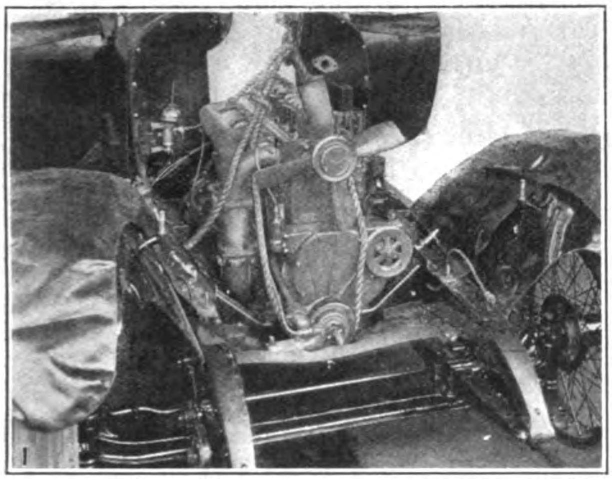
This is true talk. The man who is interested in his job resents interruptions while he is busy, even from the boss himself.

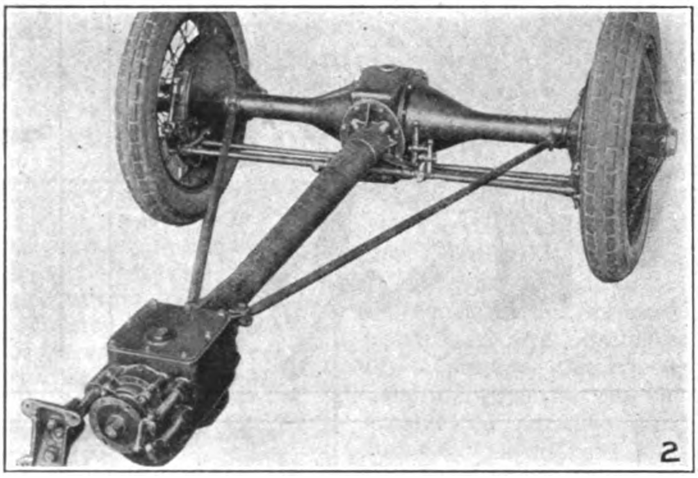
Disassembling the Marmon for Repair Work

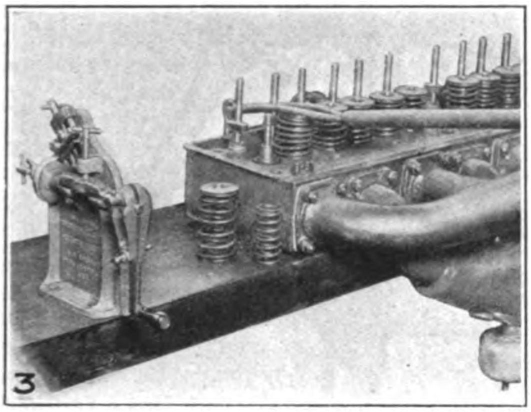
Twelve Steps in Handling Cars in the Service Station—Caring for the Motor, Transmission and Rear End Units

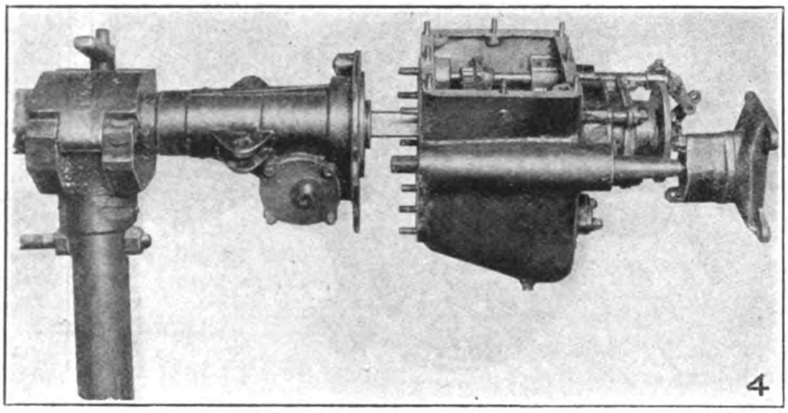
By FRED H. COLVIN
Editor, *American Machinist*

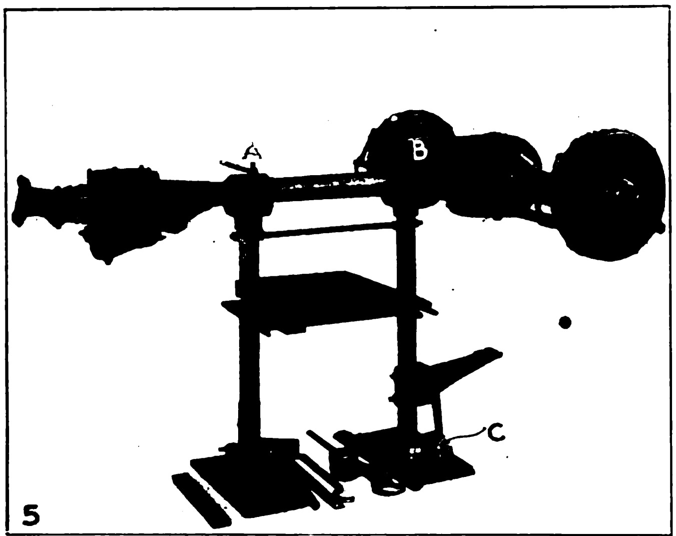
ECONOMICAL repairs are being considered more and more by buyers of automobiles and, as the cost of overhauling depends somewhat on the time required for dis-assembling, the following suggestions may be of service to all service station men, although they apply especially to the Marmon cars. First of all, it would seem natural to protect fenders, as in Fig. 1, but too few take the trouble. The main object of this view, however, is to show how to handle the engine quickly and safely. Valve facing is shown in Fig. 3 while











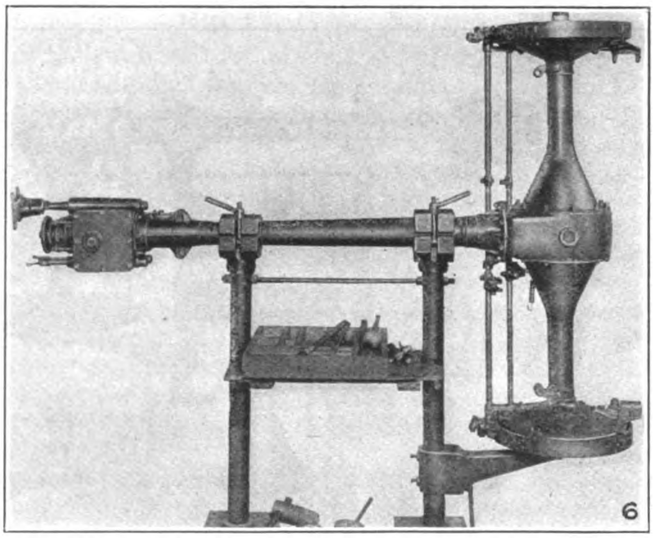
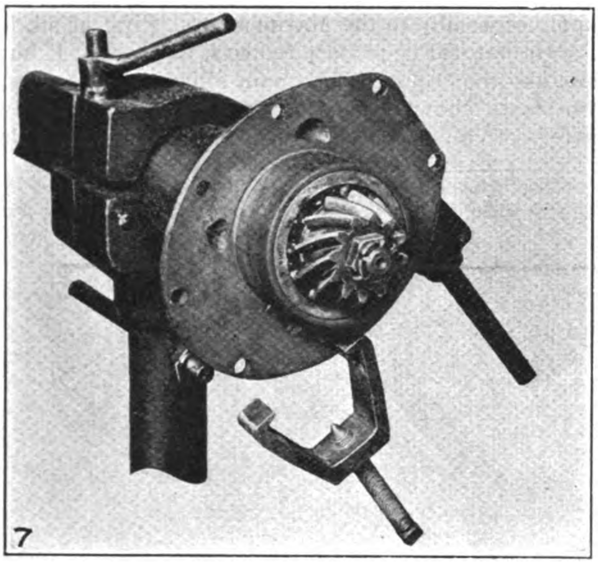


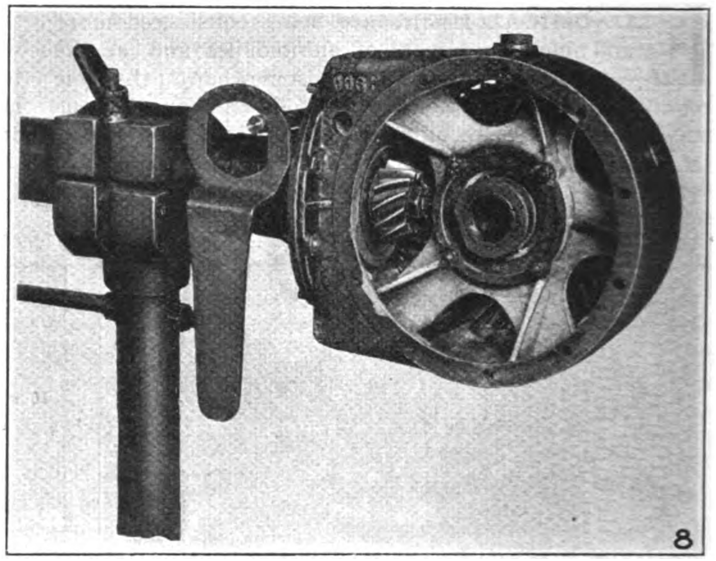
FIG. 1—METHOD OF SLINGING MOTOR FOR HOISTING. FIG. 2—REAR END UNIT REMOVED FROM CAR. FIG. 3—TAKING OUT VALVES AND TRUING THE SEATS. FIG. 4—PULLING OUT THE TRANSMISSION CASE. FIG. 5—WORKSTAND FOR REAR END; CLAMPS AT A, B AND C. FIG. 6—AXLE SWUNG UP ONTO SUPPORT

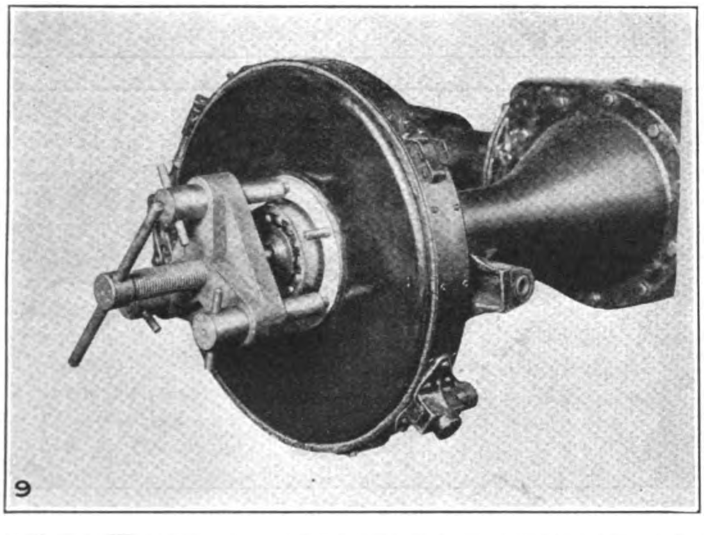
Figs. 2, 4, 5 and 6 show the stand used for handling the rear axle assembly with the work in different positions.

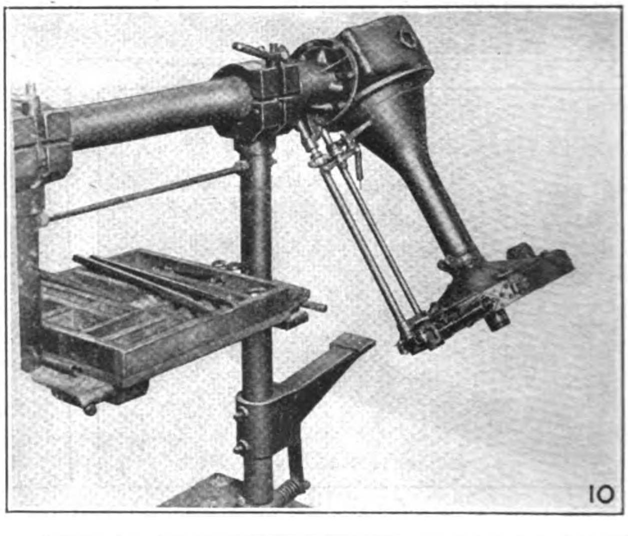
The driving pinion and the puller for removing it are shown in Fig. 7 while Fig. 8 shows the differential case in place. Another puller, having three legs in this case, is shown in Fig. 9. These legs screw on the ends of the studs and act on the ball bearing shown.

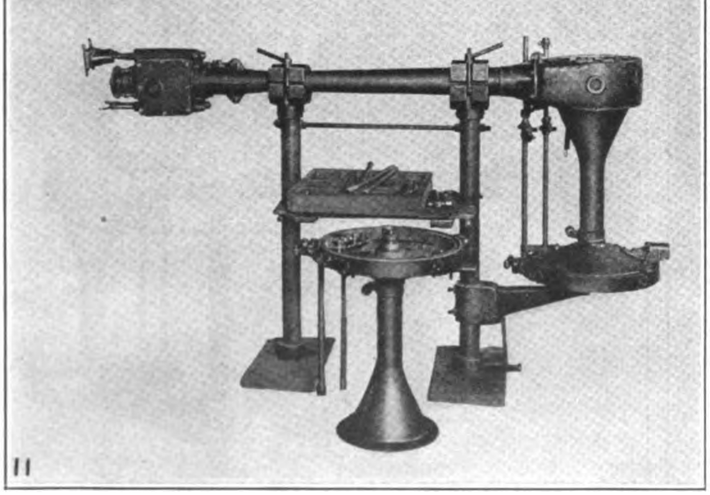
Figures 10 and 11 show a convenient form of stand for transmission work, the step acting as a support for the brake drum. Tools and small parts are kept in the tray on the stand within easy reach. More details are shown in Fig. 12, where the housing has been removed, exposing the inner roller bearing. All these and similar devices help reduce the cost of overhauling a car and keeping it in good shape during its life.











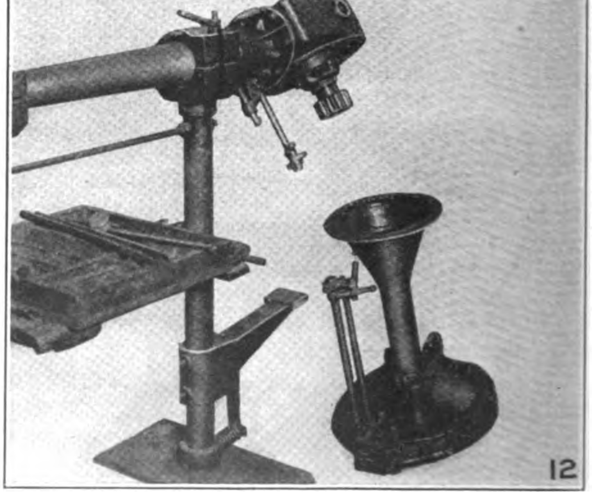


FIG. 7—READY TO PULL THE DRIVING PINION. FIG. 8—DIFFERENTIAL UNIT WITH AXLE HOUSINGS REMOVED. FIG. 9—PULLING THE REAR-AXLE BALL BEARINGS. FIG. 10—REAR AXLE PARTLY DISASSEMBLED. FIG. 11—SHOWING CONVENIENCE OF WORK STAND. FIG. 12—AXLE HOUSING REMOVED SHOWING INNER BEARING

Industrial Cost Accounting for Executives

Introductory Chapter Outlines Whole Problem to Be Treated in Series—Subject Matter Based on Experience in Many Plants—Purpose of Series

BY PAUL M. ATKINS

> **THE FIELD of cost accounting has long been an industrial battle ground. The professional cost accountant, with little knowledge of actual production methods, has advanced one point of view, the engineer another, and the factory cost accountant still another.**
>
> **Between these various fires the bewildered manager has had to conduct the business, pulled this way by one partisan, that way by another. Unfortunately his knowledge of the subject is usually insufficient to enable him to judge accurately the value of the various claims and theories presented to him. Most books on cost accounting are too technical for him and presuppose an acquaintance with accounting methods which he may not have.**
>
> **With the executive's predicament in mind, this series by an expert on cost accounting is presented with confidence that it will fill a long-felt want.**

WHEN a busy factory executive finds himself confronted with a series of articles on a subject like cost-accounting, he is properly desirous of knowing what he may expect from spending his time reading them. It has also been proved frequently that it is much easier to solve a problem when one has had a general view of it than when one begins at once with some detail and endeavors to work out its solution. For these reasons, I feel that it would be most helpful to the reader to give him a brief survey of what is to follow in the succeeding articles of this series. In this way he can see if they seem to hold for him what will be of value to him. If he decides in the affirmative he can get an idea of their organization and be prepared to fit into their proper places the various details as they are developed.

In the first place, these articles have been written with the idea that cost-accounting is essentially a part of the factory records and is a means of representing, in terms of dollars and cents, what goes on in the factory. No one, not familiar with the work of the factory, is properly equipped to install or operate a cost-accounting system. At the same time, no one is properly trained for this task unless he also knows something about general accounting methods. The cost accounts must tie in with the financial accounts, while the controlling cost accounts are usually kept in the general ledger. Hence, if the cost accountant is not trained in the fundamentals of accounting, he finds himself almost hopelessly handicapped for his task.

This explains the reason why so many cost accountants fail. They lack experience in one or the other of the two phases of their work. It also explains why so often we find professional accountants and practical shop men and engineers at logger-heads over the cost records and the way they shall be kept. Both sides are right in feeling that the cost accountant should know something about their approach to the problem and both are wrong in thinking that their side is the only one or the most important one. Cost-accounting is really a bridge between the factory and the general accounts and it needs to be firmly anchored at both ends. The effort is made in these articles to keep both points of view in mind and show their relationship to each other.

With this brief sketch of the approach which these articles make to the subject of cost-accounting, let us now turn to a consideration of their contents. It is planned to have thirty of them altogether and they fall quite naturally into seven groups. After outlining the several groups, we will briefly glance at the topics to be treated in the individual articles.

In the first of these groups some preliminary topics are discussed. Some of them, like the organization of the company, may seem at first glance rather out of place, but later on it will be evident to every careful reader why it was brought in. The second group deals with the question of material, and explains the control of material in all the various effects which it has on the cost records. The next section does the same for labor.

The fourth group takes up the problem of expenses. Often there are difficulties of a practical nature in handling expenses but the troubles of a theoretical sort have usually been magnified. The effort is made in these chapters to present the subject in such a way that the fundamentals of expense records may be easily grasped.

The fifth section leads us to a consideration of burden, as to what it is and how it should be applied to the product. It will be seen that all expenses are not a part of the manufacturing burden and that all of that burden is not always properly chargeable to the product. Several methods of burden application will be explained, in particular one which is especially applicable to metal-working industries.

In the sixth division, the method of finding the cost of the product is taken up. In addition, some pertinent suggestions for the operation of the cost department are offered. In the last group the interlocking of the cost-accounting with both production and the general accounts is explained in the light of what has been said in previous articles. Certain cost records, which do not form an integral part of the cost accounts but which are of great use to the management, are developed.

In all these chapters, sound theory is not sacrificed to expediency and, at the same time, impossible and useless methods are not presented. The articles will be illustrated by methods which I have personally tested out in actual practice, and, while that does not mean that they would be satisfactory for all occasions, it does mean that they have all survived the test of actual application. Sound practice can only be based on sound theory and sound theory can only be developed by the study of actual experience and careful analysis of the results.

The foregoing gives a brief synopsis of the following articles but for those who would like a little more detailed information the remainder of this article will be taken up with a hurried survey of the individual chapters. Such a survey will serve to amplify the outline which has already been given and will make clearer the reason why certain topics have been included.

In the article which follows this one and is entitled, "Executive Uses for Cost Records," an outline is given of the possible uses of cost records, particularly to the executive. It is an article which is prepared on the same lines as this one in that I try to point out some of the ways in which cost records may be utilized to benefit the management and so indicate why it is worth while reading about cost systems at all.

In the good old days, the man was considered a good salesman who could slip something over on his customers and get away with it. He was thought of as a sharp, shrewd trader and a good business man. Now we are coming to realize that sharp practice is not worth while, but that it is better business to give our customers their money's worth. I am trying to follow out this latter idea in what follows and explain to my readers in these first two articles just what they may expect these articles to contain and what they may hope to find in the way of benefits to be obtained from a cost system. Of course, all I can attempt to give here are some samples, or better, a description of my goods, but I hope that from this the reader can decide whether or not he wants more, and, if what I have to offer in these articles is what he wants or needs, I am quite hopeful that he will not be disappointed.

A Survey of Cost Elements, Records and Relationships

In the third article, I shall try to make plain the various elements of manufacturing cost. On the face of it, it may appear simple. Material, labor and burden are commonly accepted as these elements. The difficulty comes when one tries to define these elements in a useable and practical fashion. It is necessary to obtain such definition before undertaking any discussion of industrial cost-accounting. In the fourth article comes a summary of the cost accounts and journals by means of which the cost records are kept. The details of this summary are included in later articles.

The next two articles are likely to seem quite misplaced for they deal with the functions of a business and their organization. Yet fundamentally expenses are nothing more nor less than the costs of carrying on the various departments of the business, and hence it is quite impossible to understand either the recording or distribution of expenses unless the significance of the various departments and their interrelationship to form an organization is realized. The second of these articles takes up the question of an organization manual.

In the following article, a topic is taken up which is seldom touched on by writers on cost-accounting in any adequate fashion. This topic is the service of the production control system to the cost-accounting system. Yet a good system of production control is almost always a prerequisite to satisfactory cost records. By far the larger part of the mass of details which the cost department must handle comes from the planning department, and the aid which a good planning department can give to satisfactory cost-accounting is incalculable.

The next three articles deal with the records for material. Since the cost records for material come from the production system, it is necessary in one of these articles to trace the control of material till it enters the cost system. Another article is devoted to the problem of the accurate pricing of material withdrawn from the store-room. This seems like a very simple little problem and yet it is one of the places where some of the most serious errors in the cost records are made. Three methods are explained for dealing with the problem. The last article takes up the question of maintaining correct inventory balances and explains a simple but practical method for accomplishing it.

Only one article is given to a discussion of the payroll and the details which are needed to make it up. There are two points somewhat out of the ordinary in this article which it may be appropriate to mention. One is the emphasis laid on the cost of wages calculation as a factor in selecting a method of wage payment. The other is the use of a labor journal to meet the needs of a factory where there is an extensive and constant shifting of workers from one task to another.

Expenses

The next article will deal with the question of expense classification and also will take up the scheduling of budgeting of expenses. It serves as an introduction to several articles on expenses. The following one will give an outline of a typical symbolized expense classification. It is the result of much experience and should serve as a guide for anyone who is faced with the problem of preparing a similar classification. The next article is devoted to a discussion of depreciation and other fixed charges, charges which are a vital matter to the manager for they continue to run along whether business is dull or brisk and cannot be stopped by shutting down the factory.

There will then follow two articles dealing with current expenses, one given up to a discussion of manufacturing expenses both direct and auxiliary and the second to administration and selling expenses. After them will come an article in which a satisfactory method for the recording of all these various expenses will be explained. It will be found that a good many expense accounts will be suggested as desirable in order to permit the necessary analyses of expenses and if such accounts are set up in the ordinary fashion, they will be much too cumbersome.

Interest and Cost

The eighteenth article will be devoted to a summary of the pros and cons in regard to the desirability of including interest as an element of cost. I shall try to make clear that this question is not so serious as it is often supposed to be and to indicate a reasonable attitude to take toward the whole problem.

The succeeding article will take up the question of the distribution of expenses so as to obtain the departmental burden. This is a topic which presents serious difficulties and is usually side-stepped by most writers on cost accounting by saying that it should be done on some *appropriate* basis and then they forget, with hardly an exception, to state what the appropriate basis is. Two practical methods will be presented. They are not ideal; they are not entirely satisfactory; but they will work, for they have worked.

We have now reached the articles dealing with bur-

den. The first will be given up to a discussion of what burden is, the difference between earned and unearned burden and how the unearned burden may be disposed of. The next two will take up several different methods of allocating the earned burden to the product. The machine rate method which is of especial interest to metal-working industries will be developed with particular care.

The Operation of the Cost Department

In the article on the recording of costs which now follows, not only will methods for recording the cost of the product be discussed, but also the improvements which the company may make for itself from time to time. All too frequently, this rather significant detail is overlooked and it is of particular importance to those industries which are using and often making large quantities of tools.

The twenty-fourth article will discuss certain aids to efficient and rapid cost recording, including not only machines of several kinds but also standard practice instructions for controlling the work of the department. The following article will contain a sample of standard practice instruction which may serve as a guide to those who wish to prepare similar instructions, the value of which cannot be realized until they are tried.

The Utilization of the Cost Records

The next article will deal with the tie-in between the cost accounts and the general accounts. It will follow the same outline as the earlier chapter on much the same topic but it will be written with the idea in mind that the reader has read the intervening articles, and so will be ready for this more rigorous treatment of the topic.

The following two articles will present some of the cost statistics which do not ordinarily form a part of the regular cost accounts but may be obtained from them, as well as the uses of these statistics and the cost accounts as an aid in production control. The relationship of the cost department and the planning department is not one-sided, but reciprocal.

In next to the last article will be given a brief but comprehensive selected bibliography of books on cost-accounting so that the reader who wishes to study the subject more intensively may be guided in his efforts. At the end of the series will come a concluding article.

This, in brief, is what I plan to cover in this series of articles on cost-accounting. I hope that my readers may obtain therefrom assistance and guidance in solving their problems. Good, well-fitting cost-accounting systems do not come ready-made. They must be tailored to fit. I have no expectation that the methods which I shall outline in these articles could be adopted without any alteration by any company, but to the intelligent man who is not entirely acquainted with this subject, they should bring fruitful suggestions.

Grinding Off Stock

By John Mark May

The article, Grinding Off Stock, by Entropy on page 552 of the *American Machinist* brings to mind another axe factory that, about twenty-five years ago, was doing a profitable business, one as large as their power supply would permit. They used water-power and used all that was furnished by the stream upon whose bank they were located. This company operated less steadily from year to year and with an ever-decreasing number of employees for a period of about ten years. At that time they closed their doors.

There was difficulty experienced in getting the operators to use improved methods but there is some grounds for the belief that the management could not foresee any advantage in adopting improved methods. They allowed matters to drift along until their business had gone to such an extent that very radical changes were needed. Then they found that the men, having worked so long without any changes, seemed to have lost any progressive spirit that may have been present at an earlier period. Had the management in this case and perhaps in the case described by Entropy been believers in evolution, as far as manufacturing processes are concerned, it is possible that the one might still be in business and the other more prosperous than they now are.

I cannot quite agree with Entropy that the solution of the problem, as far as the manufacturing problem applies, lies in the employment of younger men who have no precedents to break down. I would suggest, however, that, instead of changing directly to the wheel that was soft enough to do the work satisfactorily, a very gradual change be made by using wheels that are only the least bit softer for the first change, believing that the vast majority of men would soon adapt themselves to bearing on slightly less. When this has been accomplished, succeeding steps can be taken until the desired results are obtained. The advantages would be derived from the experience of the older men who remained, as Entropy has pointed out.

The Desire to Create

By Elam Whitney

One of the factors in securing the greatest efficiency among employees and one little recognized by welfare managers is the desire to create. This desire is evidenced in the discontent of a tracer who wants a chance at drawing as well as the discontented machine operator who wants to be transferred to the tool making department. It is quite often the cause of so-called government work in the various machine shops and wood making departments, the wasting of employers' time while the employee is making parts for some device of his own. This practice is not so common among employees who are engaged in creative work and are made to feel that they are a part of the factory organization and not merely one of the machines.

This creative desire is not always the cause of the employee working on devices of his own, as is evidenced by the great amount of automobile repairing, nickel-plating, etc., being done on the companies' time. This practice is often caused because of the example set by the foreman in doing these same things himself. There is one large concern which has been very successful and at the same time has almost ignored this desire to create. But they have compensated to a great extent by establishing a minimum wage. Excellent results will follow a careful checking up of employees' ambitions and careful guidance and development along the line of greatest benefit to employer and employee alike.

United States—Exports of Metal Working Machinery

Period—1909 to 1921, Inclusive

Country	1909	1910	1911	1912	1913	Annual Average for 5 Years	1914	1915	1916	1917	Fiscal Year 1918	July 1st to Dec. 31st 1918	1919	1920	1921
Germany	$943,119	$1,804,682	$2,523,735	$2,953,361	$3,175,188	$2,280,017	$2,167,240	$ 121,756	$........	$........	$........	$........	$ 8,746	$ 144,192	$ 118,393
England	907,199	1,315,903	2,268,169	2,581,682	3,209,559	2,056,502	2,988,684	11,842,842	19,925,934	15,835,434	17,537,334	9,588,126	14,960,613	10,760,957	2,545,393
France	307,145	691,480	962,890	1,267,831	1,936,908	1,033,251	1,771,525	8,695,826	13,316,702	29,254,379	20,270,530	6,331,391	15,785,280	7,595,733	3,924,361
Canada	214,029	336,172	766,127	1,362,326	2,326,270	1,000,985	1,199,356	1,813,188	6,464,332	7,780,396	3,751,327	3,072,263	4,034,646	5,815,314	1,218,012
Russia in Europe	71,655	234,776	389,330	547,752	1,088,751	466,453	1,333,644	2,123,195	10,280,566	12,587,938	1,918,405	942	87,677	178,270	1,179
Belgium	154,470	162,529	397,157	646,541	786,679	429,475	552,531	35,416	....	....	....	420	3,882,163	1,920,172	662,127
Austria-Hungary	225,198	175,525	237,152	398,804	600,593	327,454	268,010	24,256	....	....	....	....	4,939	5,782	....
Italy	93,653	134,583	351,271	273,344	437,910	258,152	421,603	511,134	4,779,178	8,771,496	5,076,878	1,129,845	1,892,070	1,488,818	239,270
Australia and Tasmania	94,184	138,392	281,979	349,638	406,093	254,057	1,316,952	282,487	800,825	664,264	400,068	255,302	669,591	885,490	490,977
Brazil	23,063	19,657	128,454	331,422	346,187	169,757	115,974	55,106	29,606	55,409	164,587	110,913	616,396	455,184	726,228
Sweden	23,472	98,673	138,748	166,977	241,373	133,849	310,613	621,458	204,840	313,044	96,737	....	842,019	446,787	109,806
Netherlands	23,700	70,855	139,407	143,528	260,893	127,677	186,756	79,403	331,559	436,128	23,580	....	668,046	361,024	153,961
Argentina	72,871	237,123	88,155	117,061	112,747	125,591	109,836	25,700	142,907	154,581	166,041	66,385	442,660	551,407	351,143
Japan	41,555	87,160	236,733	133,546	119,558	123,710	120,166	86,166	437,159	1,092,317	2,525,276	2,254,151	5,383,184	4,250,583	2,636,018
Mexico	175,403	84,892	160,027	46,977	83,259	110,112	74,706	37,530	103,083	97,631	314,534	92,178	319,719	610,572	748,894
Scotland	44,627	45,428	50,836	97,313	201,584	87,958	185,649	449,470	509,000	461,489	858,194	243,804	249,267	238,140	152,928
Cuba	10,295	42,072	66,470	89,900	124,669	66,681	146,596	100,507	151,886	334,512	278,698	171,820	737,238	1,218,869	575,683
Spain	23,202	36,340	53,970	62,536	109,624	57,134	111,686	98,693	776,495	1,686,392	1,252,525	89,471	1,282,204	1,144,844	369,031
Norway	10,769	34,133	44,576	91,332	79,366	52,035	92,729	211,640	233,931	356,514	121,018	248,687	470,843	158,200	29,452
Denmark	15,905	12,486	39,424	59,025	84,753	42,319	48,204	247,244	86,797	338,920	21,652	10,653	439,109	234,491	31,771
New Zealand	11,175	15,114	39,131	46,958	54,732	33,422	36,260	21,679	68,926	67,192	56,731	27,136	123,399	198,261	119,695
Chile	112	29,302	24,649	59,662	43,930	31,531	85,168	28,430	58,447	426,980	792,882	230,181	677,018	443,379	254,768
British India	19,088	45,765	20,162	28,281	43,717	31,403	17,953	23,700	52,225	273,744	1,271,698	561,287	900,429	1,374,068	1,422,184
Panama	41,732	34,919	17,031	9,923	10,886	22,898	35,210	4,736	52,061	92,844	35,453	22,564	53,620	71,800	62,002
British South Africa	7,309	7,340	19,389	41,193	27,671	20,580	28,822	29,917	71,478	143,582	194,322	98,956	484,545	336,182	312,822
Philippine Islands	10,183	8,933	23,387	19,162	5,824	13,498	10,266	13,640	12,568	25,936	78,673	60,568	252,505	251,431	186,656
Peru	....	2,399	6,926	15,073	40,651	13,010	35,294	31,631	30,151	71,477	77,964	44,783	153,905	222,829	190,613
Finland	....	....	8,956	25,644	24,947	11,909	35,934	2,784	64,215	26,058	2,636	....	110,364	63,106	20,620
Switzerland	7,271	7,338	7,416	18,653	17,108	11,557	22,627	57,403	54,052	117,889	178,264	....	230,333	257,935	18,889
Dutch East Indies	9,335	4,365	8,341	26,443	6,366	10,970	20,216	9,229	56,281	245,594	168,684	243,678	614,498	326,086	361,296
Straits Settlements	340	1,044	29,074	7,103	14,638	10,440	18,930	3,514	5,186	22,036	10,357	11,616	29,170	53,420	27,815
China	7,117	6,339	13,287	19,923	3,192	9,972	17,668	25,321	54,456	119,245	109,780	87,710	1,360,433	932,351	371,184
Uruguay	....	11,193	5,515	19,305	13,828	9,968	20,612	1,845	5,382	27,162	29,281	5,770	47,014	53,833	19,898
Portuguese Africa	....	3,954	5,755	9,437	7,418	5,313	4,523	8,072	4,052	13,007	21,761	6,139	17,662	22,292	74,133
Japanese Leased Ter. (China)	2,863	....	17,020	5,877	120	5,176	6,909	6,559	453	15,340	4,316	3,845	31,700	10,621	7,452
Venezuela	11,909	761	4,100	2,941	4,706	4,883	4,950	6,975	7,080	17,365	25,581	4,585	22,808	50,875	50,613
Colombia	3,462	1,240	7,795	1,939	8,967	4,681	16,838	11,572	9,488	20,859	17,087	3,548	27,550	112,043	107,909
Turkey in Europe	....	....	6,750	9,693	3,105	3,910	1,911	210	....	....	....	....	941	32,537	10,395
Ecuador	815	2,006	1,054	13,659	510	3,609	5,077	3,567	2,972	16,700	14,307	2,803	7,716	18,736	25,181
Newfoundland and Labrador	9,339	283	2,358	2,810	1,992	3,357	958	519	6,216	5,977	7,824	1,500	8,341	13,746	7,879
German Africa	....	5,976	2,091	6,930	1,491	3,298	308	860	90	....	....	....	....	1,353	....
Ireland	152	1,634	15	7,782	6,512	3,219	4,297	2,489	2,869	2,931	....	1,293	12,066	136,470	62,197
Portugal	1,892	4,232	3,149	3,070	1,391	2,747	8,903	1,612	14,829	75,987	67,718	11,185	49,343	64,086	14,020
Chosen	4,958	325	5,378	1,179	50	2,378	....	....	5,389	6,398	3,166	580	2,306	12,403	4,447
Costa Rica	1,542	3,481	3,921	1,018	1,432	2,279	2,602	48	3,163	3,715	9,875	1,216	4,120	19,057	7,364
Turkey in Africa and Egypt	6,089	1,242	597	3,096	176	2,240	....	....	....	....	....	....	....	....	....
Santo Domingo	830	1,087	559	4,272	3,837	2,117	2,990	4,315	6,280	33,370	52,196	6,580	24,239	49,103	54,932
Other British East Indies	165	....	357	6,230	3,007	1,952	589	450	250	198	15,356	10	12,754	6,290	1,289
Hongkong	1,905	2,040	1,779	1,061	59	1,369	660	....	905	2,391	15,565	24,043	57,657	197,338	111,451
Br. W. Indies—Barbados, Jamaica Trinidad, Tobago and Other Br.	197	1,387	4,891	307	23	1,361	2,220	2,218	2,120	12,446	23,312	5,566	29,199	79,259	65,888
Bolivia	61	....	....	5,937	187	1,237	9,896	291	56	1,725	15,679	12,390	22,353	14,831	6,133
Turkey in Asia	....	442	330	375	3,219	873	1,468	4,529	....	....	....	....	1,252	5,457	2,862
Salvador	738	1,120	2,000	....	241	820	2,108	36	2,752	7,066	12,530	445	4,673	3,794	5,508

United States—Exports of Metal Working Machinery—*Continued*

Period—1909 to 1921, Inclusive

Country	1909	1910	1911	1912	1913	Annual Average for 5 Years	1914	1915	1916	1917	Fiscal Year 1918	July 1st to Dec. 31st 1918	1919	1920	1921
Russia in Asia		242	1,416	393	1,600	730	1,381	365,389	2,052,170	2,740,874	111,263	8,425	157,840	7,336	
British Guiana	89	1,316	1,668	242	206	704	61	163	367	3,191	12,602	10,713	8,820	6,462	331
Roumania	56	1,814		1,431	110	682	3,239	1,200					6,344	104,841	244,374
Guatemala	267	750	224	673	997	582	4,312	294	4,883	4,633	2,595	3,087	12,115	9,923	13,947
British West Africa		792	434	1,666		578	557	2,155	3,894	5,843	1,996	16,904	14,208	8,059	1,434
British Honduras			2,855			571	435	273	19	187	321	1,042	382	107	471
Greece		25			2,310	467	548	779	10,345	7,327	630	720	41,588	55,372	50,554
Nicaragua	895	344	521		80	368	1,104	449	233	1,251	905	607	15,778	6,037	5,543
Siam	215		435	294	870	363	1,449	354	225	6,477	15,047	4,793	6,139	2,500	7,190
Haiti	139	397	939	186	100	352	125		826	5,174	30,017	620	7,239	4,481	1,812
French Oceania					1,645	329			3,061	120	94	65	7,408	4,880	1,201
Honduras		647		310	607	313	110	5,418	2,358	2,360	1,429	364	10,636	30,498	27,441
French Guiana	991	72				213							260	9,955	12,573
German Leased Ter. (China)	833					167				543					
Bermuda	282	144		355		156	131	50	289	161	1,091	79	607	2,386	3,092
Dutch Guiana			700			140				916	446	283	675	2,046	19,029
Bulgaria	120	480			13	123	8,173							14,071	1,609
Persia					400	80		13,628		203	3,190				4,425
French Africa				210	175	77		500			314		8,436	9,749	1,591
Other British Oceania	18	118		79	72	57	309	205	21	279	18		212	67	1,869
Canary Islands				144	100	49				10	8,558		91	1,079	328
French Leased Ter. (China)		235				47					77				
German Oceania				4	106	22							140	1,283	940
Danish West Indies	36				7	9		12	39	1,079	5		788	5,010	3,903
French West Indies					11	2		250	8	9.787	5,254	2,138	7,777	3,468	4,879
Dutch West Indies					9	2	31	15	5,034	3,402	13,743	209	1,264	1,297	15,147
Azores and Madeira Island							416	272	104				290	8,681	4,872
Gibraltar							10	200	1,015	2,268			4,044		
Iceland and Faroe Islands										328	218	80	616	1,702	950
Malta, Goso, etc.							965							135	
Paraguay							237				14,036		5,484	10,115	
Aden								125					805		
Belgian Kongo										1,302	53	75	18,267	7,222	1,603
British East Africa							300		346	2,839	8,621	3,603	159	6,925	7,060
Egypt							2,839	69	178	11,153	3,132	2,055	11,685	31,412	14,419
Liberia									10	615					
Madagascar									60	1,425	1,588		975	2,050	17
Morocco									355	5,528			737	5,337	1,066
Spanish Africa										67		10,860			
French East Indies											25		5,785		476
Miquelon, Langley													25	1,105	19
Poland and Dantzig														38,676	108,281
French Indo-China														2,982	
Czecho-Slovakia														2,859	
Hungary														2,324	
Yugo-Slavia, Albania, etc.															124
Hedjaz and Arabia															128
Palestine and Syria															401
Annual Totals	$3,640,034	$5,975,503	$9,626,965	$12,151,819	$16,097,315	$9,498,327	$14,011,359	$28,162,968	$61,315,032	$84,935,410	$58,327,668	$25,213,050	$58,507,942	$44,312,233	$19,635,821

Note.—Period from 1909 to 1918 inclusive consists of Fiscal Years ending June 30th, and period from 1919 to 1921 inclusive consists of Calendar years.

Ideas from Practical Men

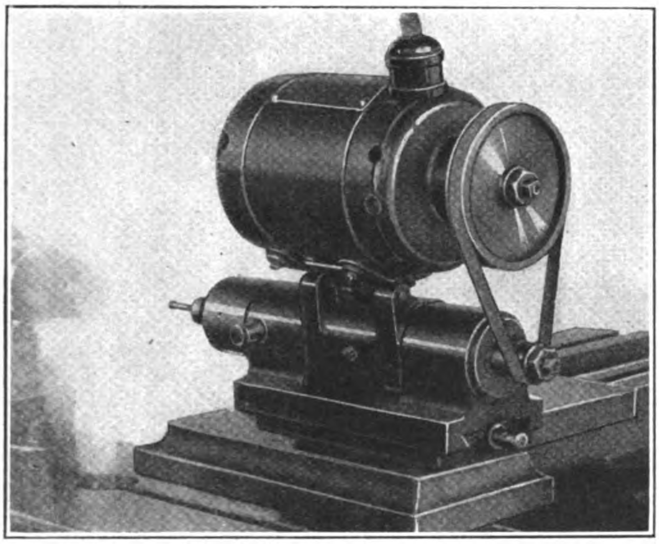
Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Experiment With High Speed Grinding Head

By Ellsworth Sheldon

Almost the final operation performed upon the Jacobs drill chuck is to grind the jaws to insure concentricity of running. As some of the chucks are quite small, the grinding wheels are correspondingly minute and must run at exceedingly high speeds. Some of the little wheels are but $\frac{1}{16}$ in. outside diameter and run at a speed of 50,000 revolutions per minute.

The work of grinding has been done on a grinding machine of standard make with the regular internal



EXPERIMENT WITH HIGH SPEED GRINDING HEAD

grinding head and, owing to the necessity for frequent renewals, the Jacobs Co. has been making the spindles in its own shop.

The work of making them is very simple but as a spindle could not be made to run at this excessive speed for more than 8 or 9 hours without developing a looseness in the bearings that would put it out of service, the making of a new spindle every day for each machine not only imposed a monotonous burden upon the tool room force but greatly increased the overhead charges on the work.

To relieve this burden the company has been experimenting with a "Dumore" high speed grinding attachment and the cut shows the device mounted upon the machine, doing away with the back counter and belt drive. At the time the photograph was taken the Dumore had been running more than 400 hours (not consecutive) and had not developed any perceptible looseness in the bearings. The motor is running 15,000, and the grinding spindle 50,000 revolutions per minute, upon Norma ball bearings.

Putting Limits on All Dimensions—Discussion

By Martin H. Ball

The article under the above title by John Thomas, which was published on page 639, Vol. 56, of *American Machinist*, and the discussions which followed have interested the writer very much. While there are times and places where it is best to vary almost any rule, it seems to me that Mr. Thomas is nearly right in asking for limits on all dimensions. I mean by all dimensions, those which apply to finished surfaces and not the dimensions that concern the pattern maker only. Exceptions are made in instances where the requirements for some surface without machine finish are unusually exacting.

This method does not involve as much extra work on the part of the designer and draftsman as it would seem at first thought. There are many cases where notes stating the limits on a drawing can be used, as for example, "The limits on all dimensions on this drawing are $\begin{smallmatrix}-0.002\\+0.002\end{smallmatrix}$ in." The limits may be grouped as follows: "All holes on this drawing have a limit of $\begin{smallmatrix}-0.001\\+0.001\end{smallmatrix}$ in., all diameters $\begin{smallmatrix}-0.0005\\+0.0005\end{smallmatrix}$ in. and all other dimensions $\begin{smallmatrix}-0.003\\+0.002\end{smallmatrix}$ in." Where there are some dimensions that cannot be easily grouped, these can each be limited in the usual way and the others can be taken care of by a note thus, "Where not otherwise shown, all dimensions have a limit of $\begin{smallmatrix}-0.0005\\+0.0015\end{smallmatrix}$ inches."

Placing limits on dimensions, however, does require a more thorough knowledge of the requirements on the part of the designer. Because of this fact and on account of the extra time required in designing and drafting, many who are responsible for results hesitate to insist that dimension limits be specified. But they fail to realize the time lost in the machine shop due to uncertainty and they overlook the fact that a much better product might be obtained if all concerned knew exactly what was desired.

When parts go to different departments to be machined, this uncertainty increases. The man who makes the holes may know how much allowance should be made for the shaft or pin to fit properly, but he does not know how much allowance the man who made the shaft or pin did allow. The designation desired is that which is plainest to the dullest and the least experienced worker. Any plan can be learned and used, but the plainer it is, the less will be the cost in time and material. I feel, therefore, that the plans suggested by Frank C. Hudson on page 794, Vol. 56, and by J. A. Roy, on page 188, Vol. 57, of *American*

Machinist have much merit. The only change that I would suggest is that the desired size may be always shown in large figures first and followed by the allowable tolerances, which may or may not be an equal amount above and below the desired size.

For illustration, a fit of 0.003 in. clearance is desired where a minimum of 0.002 in. and a maximum of 0.006 in. are permissible. The dimension for the hole would be $1.793\ {}^{-0.0005}_{+0.0015}$ in. and the dimension for the shaft would be $1.790\ {}^{-0.0015}_{+0.0005}$ in. The basic dimensions of 1.793 in. and 1.790 in. stand out prominently, will be read first and are likely to be understood as the sizes desired for a first-class job without further explanation from any one.

An Uncommon "Shark's Jaw"

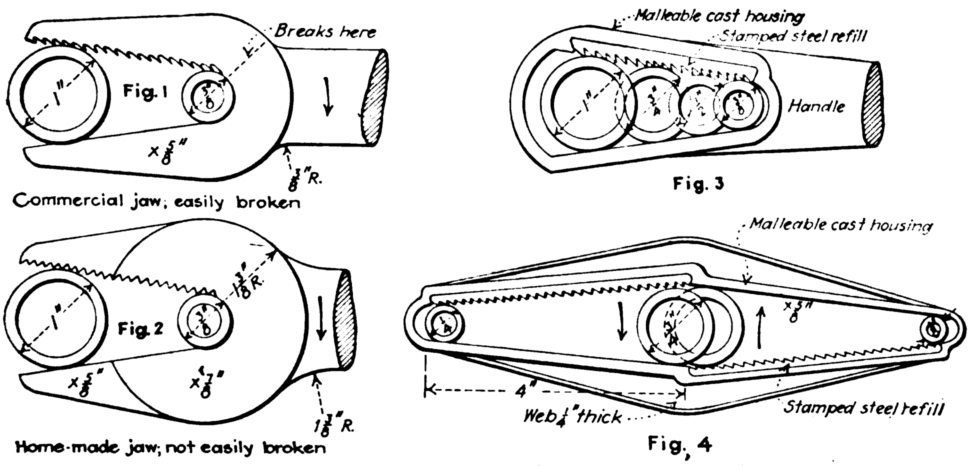
By J. T. Towlson

London, England

The common "shark's jaw," usually known in America as the alligator wrench, than which few tools are of greater all-round service, is shown in Fig. 1 of the accompanying sketches in its commercial form. Its life is long, if properly used, but, as with the Clyburn shifting spanner, the rule governing its proper use is more honored in the breach than in the observance. When it is abused it soon breaks along the line indicated in the sketch. Home made shark's jaws like that shown in Fig. 2 have greater strength here and, though a trifle heavier, they last much longer.

The tool shown in Fig. 3 is still stronger for the reason that the jaws are tied together at the outer end, leaving a triangular opening into one side of which the tool steel toothed section is inserted. The body of this tool, as also the one shown in Fig. 4, is of malleable iron. The common form, Fig. 1, is somewhat paradoxical in design in that the larger the work upon which it is used the greater is the leverage tending to break it across the throat. It is to counteract this defect that the tool shown in Fig. 4 has the triangle reversed. This latter tool is made double ended and will handle from ⅛ to ¾ in. gas pipe sizes.

[The fact that the wrenches in Figs. 3 and 4 can be used only by passing them over the ends of pipe or rods limits their usefulness.—Editor.]



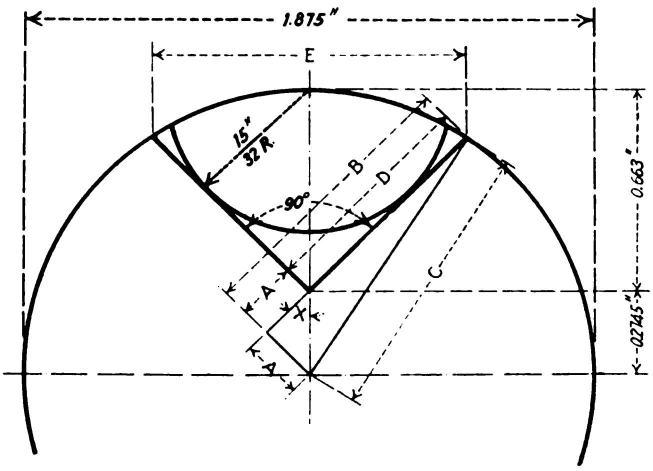
"SHARK'S JAW," OR ALLIGATOR WRENCHES
FIG. 1—THE COMMON KIND. FIG. 2—A STRONGER "HOME-MADE" TOOL. FIG. 3—SINGLE-END WRENCH; CLOSED. FIG. 4—DOUBLE-END TOOLS WITH TRIANGLE REVERSED

A Problem in Shop Trigonometry

By Edward J. Rantsch

Every now and then some mathematical problem confronts us in our regular line of work that makes us employ a little trigonometry to reach a solution. In this case it was required to make a piece with a groove of 90 deg. included angle. This groove was to receive another part having a circular form with a $\frac{15}{32}$-in. radius on one side and a radius on the other side to conform with the radius of the first piece, which was 1.875 in. in diameter. The center about which the $\frac{15}{32}$-in. radius was drawn was to lie on the circumference of the circle of 1.875 diameter, as shown in the accompanying sketch.

The first step was to take the $\frac{15}{32}$-in. radius and multiply it by 2, which gives a 0.9375-in. diameter.



A PROBLEM INVOLVING SHOP TRIGONOMETRY

Letting this diameter 0.9375 in. equal the distance across the flats of a square, and multiplying it by 1.4142 gives us 1.326 in. as the distance across the corners of the square; dividing by 2 we get 0.633 in. as one-half the distance across the corners of the square. As the diameter of the large circle is 1.875 in., the radius is 0.9375 in. Subtracting 0.663 in. from 0.9375 in., we get 0.2745 in. as the distance from the corner of the square to the center of the piece, as noted in the illustration.

Now drawing a small triangle at this point in which 0.2745 in. becomes the hypothenuse and angle x equals 45 deg., then sin x, or 0.707 $\times$ 0.2745 in. equals 0.194 in. for lengths A and A, which are two equal legs.

By drawing line C, which is a radius of 0.9375 in., we get another right-angle triangle in which A equals 0.194 in., and C equals 0.9375 in. Dividing A by C, or 0.194 in. $\div$ 0.9375 in., gives 0.20693 as sin x. Then x is 11 deg. 57 min. Multiplying the cosine of 11 deg. 57 min., which is 0.97833, by C or 0.9375 in., we get length B, or 0.917 inches.

Having found length B to be 0.917 in. and length A 0.194 in., subtract A from B and we have 0.723 in. as the length D, which is equal to one side of the groove.

Now assuming that 0.723 in. is the length of one side of a square, or in other words, the distance across the flats of a square, to get the distance across the corners multiply 0.723 in. by 1.4142, and we have distance 1.0225 in. for E. This value represents the length of the chord and is the last unknown dimension to be found. Thus we have found all the unknown dimensions by the use of shop trigonometry, reasoning step by step, a method that can usually be employed in solving the problems that arise in everyday practice.

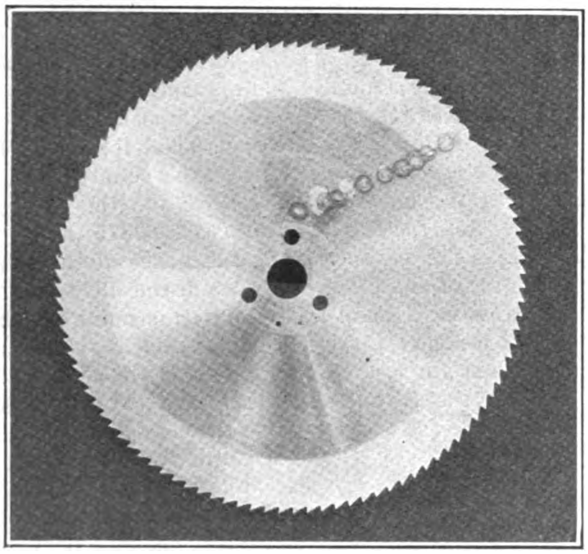
Salvaging Cracked Saws by Welding

By Ellsworth Sheldon

A method of salvaging the circular saws used on certain metal sawing machines when they have developed cracks that would otherwise put them out of business is shown in the accompanying illustration The disk is first cleaned by immersing it in the soda kettle and then, taking it to the electric spot welding machine, a row of spots is welded along the line of the crack, as the photograph shows.

Two or three teeth are then ground out of the periphery immediately behind the crack to relieve the disk as much as possible from shock at this point and the saw is put back into service. If the crack has not extended clear to the center hole, the acetylene torch is brought into play to burn a small hole through the disk at the end of the crack and thus discourage its further extension.

While this method cannot be guaranteed to save a saw, its application requires nothing but the expenditure of a few minutes time in a shop where the electric welding machine is already installed and, if it is successful, will keep in service as a valuable tool a saw that is otherwise but a candidate for the scrap pile. If it fails nothing is lost but the time.



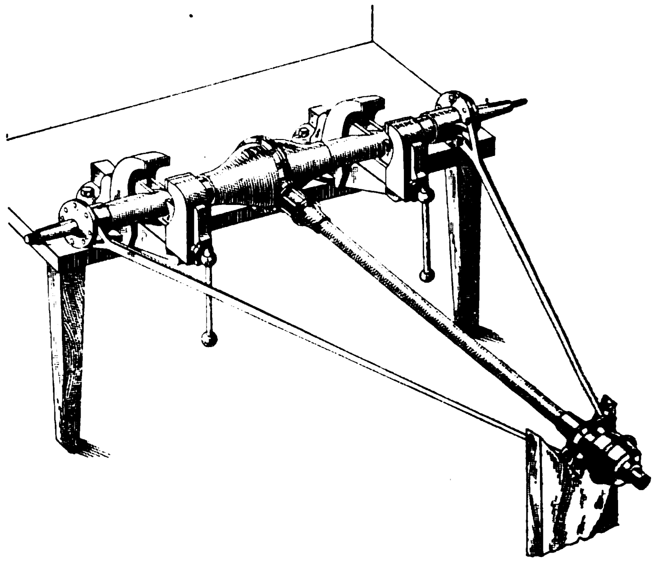
CRACKED SAW, SPOT WELDED

At the Butterfield plant of the Union Twist Drill Co., Derby Line, Vt., the writer saw in operation several of these saws that had thus been reclaimed and that were doing as good service as before they were cracked. Such a repair would not be advisable, however, on the swiftly moving saws used in the wood working shop because the consequences of failure would be too disastrous.

Two Vises to Handle Axle Assemblies

By G. A. Luers

In the absence of a special stand for holding either front axles or rear axle assemblies, which stands are very serviceable for overhaul, the use of two vises placed three feet apart on the edge of a bench, as shown in the sketch, will afford a means of clamping the axles solidly while renewing bushings, putting on spindles, aligning gears or adjusting the many parts. It is possible with an assembly like a Ford rear-end to clamp the housings in the vises, place a block under the drive shaft end and work on the universal, connection, radius rods, put in the retaining bolts, cotters, etc., as well as carry out the work of overhaul from a most favorable and comfortable working position. But a third of the time is required to assemble these parts in this manner, as well as to add to the comfort and convenience of the workman.



TWO VISES FOR HANDLING AXLES

Can These Things Be True?—Discussion

By R. Kraus

In reply to M. Tolliver's article, which appeared under the above title on page 270 of *American Machinist*, it is the writer's opinion that the problem of the heat treatment of steel can be handled in two different ways. One way is to determine a method by research, which requires a thorough knowledge of metallurgy, and the other is to make use of reliable information which can be obtained from the maker of the steel to be treated. The latter means is the one which is best adapted to the average user.

The steel manufacturer is not only glad to supply the necessary information but he will even send his specialist for a demonstration as it is to his interest to have the steel properly treated. The manufacturer is really the best one to judge how the merit of his product may be brought out. Manufacturers now pursue a broad policy in building good will and they frequently go to an expense in demonstrating their product since they anticipate the demand in a locality as well as in a special prospect.

Good information may also be found in the catalogs of allied products, as for instance in a catalog of a

company which manufactures pyrometers. All the knowledge necessary is the analysis of the steel one is using.

This condition is a reminder of what is expected from us in the successful treatment of steel and that is just a little effort to keep rigid order in the stockroom. If we are using the makers' information, we do not have to know the composition of the steel, but we must know with certainty what steel we have. This condition requires a rigid rule to mark the incoming steel immediately, by stenciling it with vivid color every few feet and at both ends. As a chart must be followed, the blueprint of it should be framed and given a coat of transparent shellac.

The suggestions made are not new, but they form one of the principles of production, namely, to avail oneself of the cumulative experience of others, which is a secret of saving time.

Two Ways of Making a Core—Discussion

By M. E. Duggan

On page 461, Vol. 57, of the *American Machinist*, P. W. Blake offers criticism of an article by the writer under the above title on page 233, Vol. 57. In presenting that article I had in mind the apprentice and the young journeyman pattern maker who have been denied the privilege of visiting in the foundry and core room, and who welcome any information they can get through the columns of trade papers. Moreover, I had in mind general pattern, molding, and core making practice and not any one specialty. I merely used the sketch as an example of the method used by the core maker in making cores with projecting members, *dried on end.*

Again I ask, "Is this method practicable and does it answer the requirements of the core maker?" We are told that the pattern maker predetermines the operations of the molder and the core maker. I don't believe this. The apprentice or journeyman pattern maker who has had little or no training in practical molding and core making is mighty poorly equipped to even hint at how the job should be done in either of these departments of the foundry. Mr. Blake says, "Any pattern maker trained in the manufacture of plumber's brass goods knows that the practical method is to use core driers on small sizes, because the driers keep the cores from warping." Why should a special training in plumber's brass goods be necessary to know and understand the "why" and the "wherefore" details that pertain, not to any individual specialty, but to general pattern making practice.

Mr. Blake mentions the word "proper" in connection with the making of these cores and driers. The word "proper" does not apply in the making of patterns, core boxes, molding, or core making. The superintendent of a large foundry doing a general jobbing business has remarked, "Make a pattern and the core boxes for it, send them to the foundry and the molders and core makers will tell you of nineteen better ways by which they can be made."

In conclusion, I think it only fair to suggest that when reading an article illustrating and describing a way to do a certain piece of work with a view to criticizing it, you either read it as it is written or *read between the lines.* If the method has any merit in comparison with your way of doing the particular job, then use it; if it has not, then pass it up.

Removing a Bushing from a Blind Hole —Discussion

By W. H. Storey
Surrey, England

In an article under the above title on page 865, Vol. 56, of the *American Machinist,* Art Weiss, in criticizing the method of removing a bushing from a blind hole as outlined by me, asks why we should not make the bushing as shown in his sketch. I think it is up to me to answer his question. I do not think it can be denied that the following points are against his method:

1. A plain standard bushing from stock cannot be used.
2. Expensive cast steel is used for the tapped portion necessitating slower machining speeds.
3. The tapping of cast steel should always be avoided if possible on account of wear and breakage of taps.
4. Due to the recess, the effective length of the bore is reduced and usually it is desirable to keep the length of the bore of blind hole bushings as long as possible.
5. The bushing may crack in hardening, (a) due to the thread, (b) due to the recess, (c) due to the excess of metal at the bottom.
6. Grinding the blind hole in the bushing is objectionable, demanding as it would a great amount of time. Blind holes are the cause of much grinding-wheel breakage and are never as satisfactory as the straight-through bore.
7. In order to grind the outside diameter a special mandrel will have to be made as a standard mandrel cannot be used.

Mr. Weiss states that my method involves the hunting up of loose washers when the bushing has to be removed. May I point out that this is not accurate, for, as with his method, a setscrew is all that is required to extract the bushing. In fact our methods are virtually the same with the exception that I require a shorter setscrew and have the tapped portion made separately from a piece of soft machine steel, thus enabling a

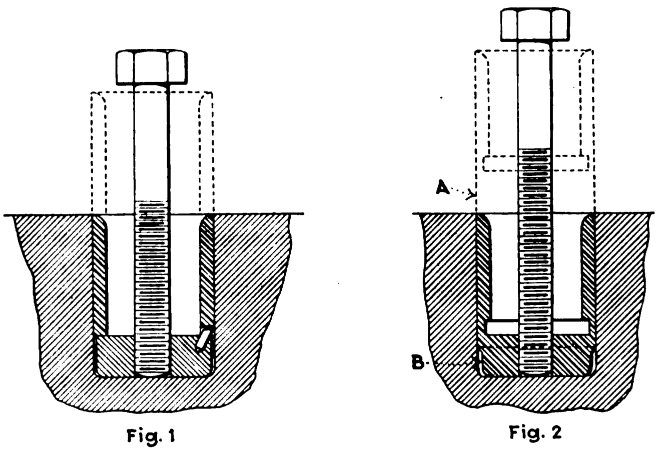


FIG. 1—THE AUTHOR'S METHOD. FIG. 2—ART WEISS' METHOD

standard bushing to be used. By my method the necessity of a recess with its attendant risk of cracking and wheel breakage is eliminated, less of the expensive cast steel is used, much less time in manufacture is required and there is no necessity for making a special mandrel for grinding the outside diameter.

If, after reading this, Mr. Weiss ever again uses the

Editorial

THERE ARE still some mechanics, and for that matter some foremen and even superintendents, green enough to be proud when they make blue chips with red tools. The proper color scheme is white. If two men take the same size cut at the same speed and one gets his chips blue and the other white, it is a safe bet that the latter has the tool which will last longer and use less power.

Statistics on Foreign Trade in Metal Working Machinery Begin in this Issue

HOW MUCH do we know of foreign trade in machinery? Much has been written—and read—about how to ship machinery across seas. The requirements for dismantling, slushing and boxing have been specified. There has been a word or two about the kind of salesmen to send abroad. Correspondence and mail matters have been touched upon.

But what of the markets? How have exports and imports grown or diminished during the past 10 years? What future is indicated? Statistics on those conditions should be in every sales manager's office. They are available, thanks to the Industrial Machinery Division of the Bureau of Foreign and Domestic Commerce, and they have been handed out piecemeal from time to time. Fortunate the man who could collect them and keep them together.

It is now the purpose of the *American Machinist* to distribute the statistics of foreign trade in machine tools for the years 1909-1921 inclusive. They will be presented each week with either a page or two pages per issue. The tables will show the values of metal working machines exported from the principal countries, the names of the countries receiving them, and the values of the machines received by each. A like arrangement will show the details of imports. Invaluable figures they have been termed by some.

No table will back up another, an arrangement that gives perfect freedom in clipping. Table I, Export of Metal Working Machines from the United States, is in this issue.

What's Wrong With the Railroad Shops?

A VERY ENLIGHTENING series of articles might be written telling the history of railroad development with particular reference to the repair shop angle. The series would tell of the strangling effect of railroad regulation as practiced by federal and state bureaus and would point out the valiant struggles made by the men in charge of the mechanical departments against conditions brought about by insufficient appropriations resulting from lack of revenue. It would also tell of the boring-from-within tactics of labor unions whose rules operated to combat every attempt at progressive management. Such a series would be pleasant to write but it would be outside of our province and would lead to no improvement.

We have the utmost sympathy for the railroad managements in so far as they are oppressed by governmental regulations, and they certainly have had more than their fair share of it, but railroad regulation is here to stay and there is nothing to do but make the best of it. If anything we could say would have any effect in lessening the oppression, we should be only too glad to shout it in 24-point type but we are not so egotistical as to harbor any such idea.

In the series we have written, and of which the second article appears next week, we have discussed things as we found them and tried to point out definite improvements which might be made. If what has been written has seemed to savor of destructive criticism, bear in mind that only a quack doctor endeavors to cure the patient before he finds out what is the matter with him. If we had nothing better to offer, the series never would have been started, for constructiveness has been the aim of the *American Machinist* since its beginning nearly fifty years ago. So far, we have contented ourselves with pointing out the faults. In later articles we shall suggest remedies, drawn from the practice and experience of other shops and applicable to railroad repair shops.

The Red Cross Roll Call

IT SEEMS ESPECIALLY appropriate that the coming Annual Roll Call of the American Red Cross should begin this year on Armistice Day. To many, the splendid service which this organization gave to humanity during the World War ended with the coming of peace in 1918. It would be unfortunate, indeed, if the energy and relief which the American Red Cross still dispenses should be unrecognized or unsupported at this time.

The Red Cross campaign to spread the benefits of hygiene, the active interest in the comfort and entertainment of our disabled Service men, and the ever-ready emergency relief—these alone would justify the annual contribution of a single dollar from each of us. Leading even these good interests, however, comes the active fight which the Red Cross now wages on tuberculosis. Support of the organization in this, the greatest of its campaigns of relief, makes membership almost an obligation for those who can give.

Just Suppose

SUPPOSE you had bought a machine which is guaranteed to turn out twenty-four pieces per hour, let us say, for $6,000. And suppose the best you can possibly get out of this machine is twenty pieces, and even the maker's expert can do no better. You would probably feel that you are entitled to a discount.

Now suppose it were the other way; that you get twenty-eight pieces instead of twenty-four, and that without straining the machine or the man or even your imagination. Would you feel that the maker is entitled to a bonus, and feeling that way, would you offer it?

Oh, come now! You know things are not done that way. Yes, but—

Just suppose.

Shop Equipment News

Baird Six-Spindle Chucking Machine

What is virtually an automatic lathe for handling five short pieces of work at one time has recently been placed on the market by the Baird Machine Co., Bridgeport, Conn. The machine, as shown in Fig. 1, is a six-spindle horizontal chucking machine and is suitable for work on small castings, forgings and bar stock requiring a number of operations such as turning, facing, drilling and threading that can be performed on a lathe. The capacity is for work up to 6 x 6 inches. The chief feature of the machine is the fact that there are always five pieces of work in operation at the same time. As many as twenty-one cutting tools can be used simultaneously. The sixth spindle is in the loading position while the others are operating, so that the work may be inserted and removed without interfering with the operation of the other spindles.

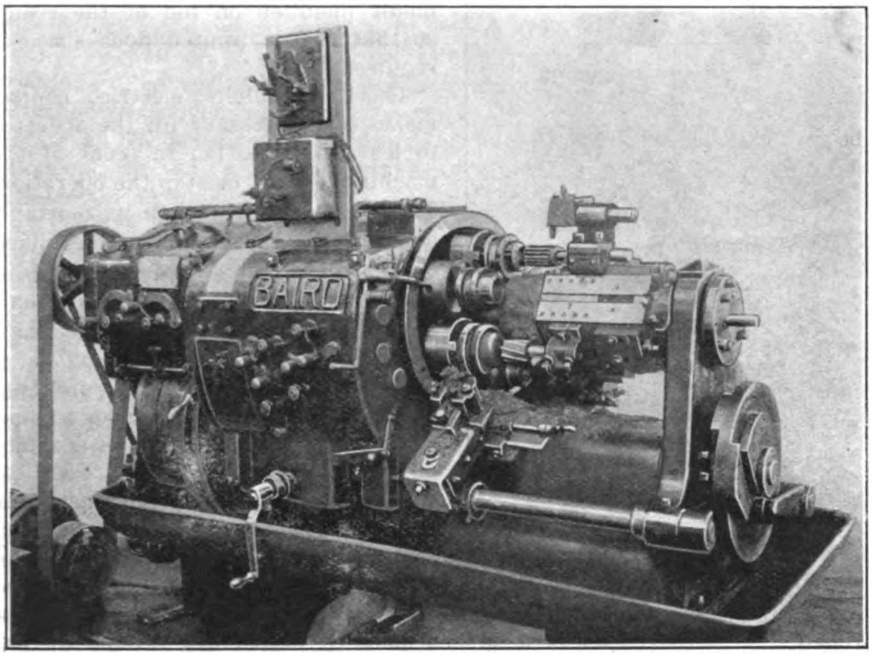


FIG. 1—BAIRD SIX-SPINDLE CHUCKING MACHINE

As the finished piece reaches the unloading position the machine automatically stops, so that a second cycle of operations will not be made on a part due to inattention of the operator. The operator immediately starts the machine again when he is ready to take out the piece, so that the five work spindles need not be stopped during the time required to remove the piece and place a new one in position. The machine can be run without stopping at the completion of each piece.

Separate toolslides are supplied for each working position with a choice of two lengths of feed with any setting. The cross-feed toolslides are mounted on the bed. The toolholders are interchangeable and are designed to receive standard forged or inset tools. The machine can be turned over by hand from either the front or back of the machine for setting the tools.

The machine is ordinarily driven by a single constant-speed pulley at a speed of 800 r.p.m., and it can be arranged for either belt or motor drive, a 5-hp. motor being ordinarily required. The spindle speed varies from $28\frac{1}{2}$ to 440 r.p.m., a total of twenty-four speeds lying between these limits. There are eight possible combinations of gear drives and three quick changes of speed available for each spindle. By changing the gears in the main drive the range of speed of all of the spindles can be raised or lowered; three changes are still allowed for each spindle independent of the other spindles. There are seventeen changes of feed for the cutting tools.

All the changes of speed and feed are effected by heat-treated quick-change sliding gears. The work can be run at the speed and feed best suited to the operation, so that a hole of small diameter can be bored at a high spindle speed while the outside diameter of the work may be turned at a relatively low spindle speed.

Rapid traverse and reverse motions are provided so as to increase the speed of operation. The minimum productive speed with the drive pulley running at 800 r.p.m. is one piece in 9 min., and the maximum is $2\frac{2}{3}$ pieces in 1 min. Chucks are ordinarily employed, but special fixtures for holding the work can be substituted. Each spindle has a means of adjustment to take up wear. Back of each spindle is a driving clutch that releases automatically to allow the turret holding the spindles to index. All operating levers are conveniently located in the front.

In Fig. 2 is shown a view of the rear of the machine, in which the cam drum and such features can be observed. A power-operated pump for cutting lubricant is incorporated. The machine requires a floor space of 93 x 46 in. and weighs about 8,500 pounds.

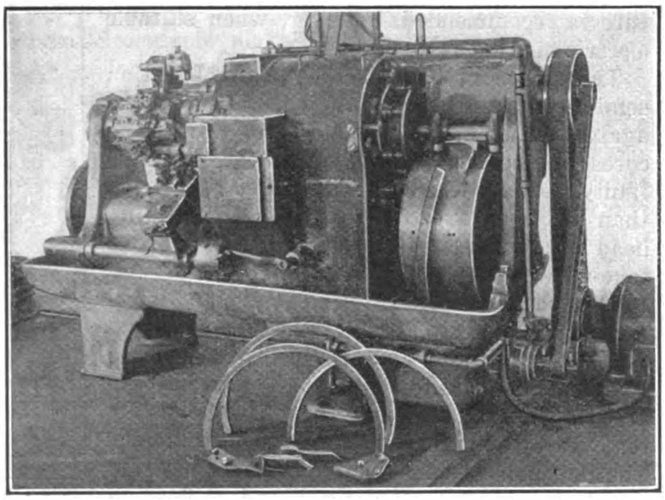


FIG. 2—REAR VIEW OF BAIRD CHUCKING MACHINE

Chambersburg Punching and Shearing Machines

The Chambersburg Engineering Co., Chambersburg, Pa., has recently developed a line of vertical punching and shearing machines on which electrical control is employed. This control mechanism is so constructed that setting and adjustment of the length of stroke can be easily made and the action then performed electrically. The mechanism by which the adjustment is made is mounted on the front of the head and can be seen in Fig. 1, as well as the foot switches by which the operation of the presses can be controlled.

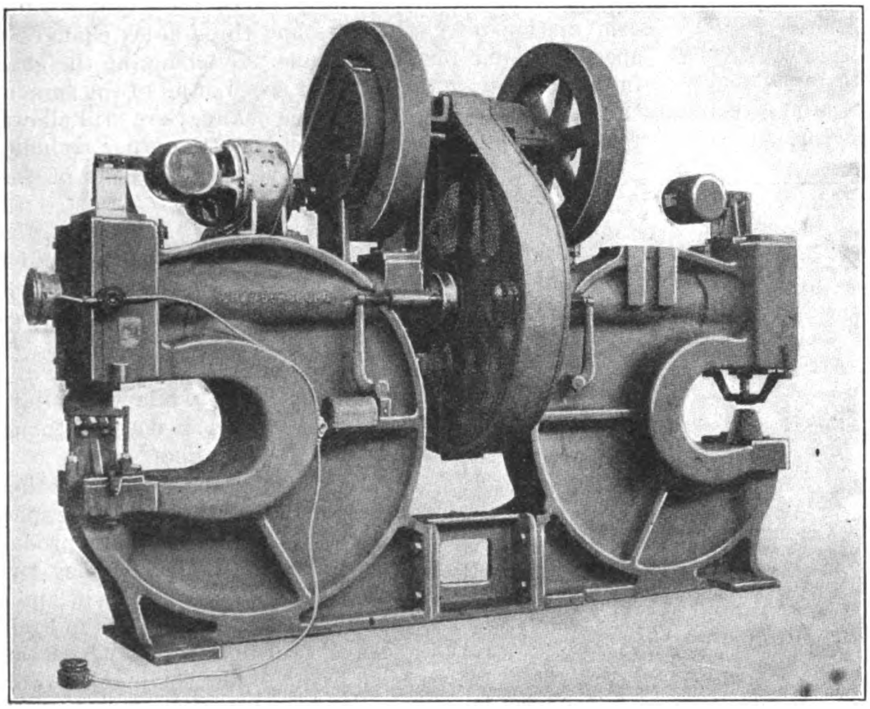


FIG. 1—CHAMBERSBURG DOUBLE-END PUNCHING AND SHEARING MACHINE WITH ELECTRICAL CONTROL

The machine as illustrated is double ended. Two units can be mounted end to end so that the same motive power can be employed for each. Although the electrical control is the chief feature of the new machines, belt-driven machines can be furnished controlled by the mechanism ordinarily employed for this type of work. Such a machine is illustrated in Fig. 2. The electrical control and adjustment feature is recommended, however, when suitable electric current is available.

The frame of the machine is of I-section semi-steel having large fillets as a safeguard against cracking in the corners. Since no cores are necessary in forming the castings, faulty sections can be more readily detected than in a box-section frame. The sliding head is a semi-steel casting and has a broad take-up wedge.

The eccentric shaft is a one-piece steel forging and is employed for the eccentric box. Sight-feed oil cups are provided on the main bearings and the sliding head. The tool blocks are made of cast steel; they can be easily removed by making a quarter turn of a handle. The punch is so constructed as to incorporate the features of both a fixed and a floating punch in one tool.

Machine-molded semi-steel gears are employed, and the pinions are shrouded. Since fractional ratios are used, smooth running conditions are promoted. On the motor-driven machine, a cut steel gear is furnished on the motor shaft. Guards can be supplied for all gears. The driving shaft runs in babbitted bearings.

Eight sizes of the machine are made. On the smallest size a punching capacity of a $\frac{5}{8}$-in. hole through a $\frac{1}{2}$-in. steel plate, or its equivalent, is provided. Plates $\frac{11}{16}$ in. thick can be split. Throat dimensions of 6, 12, 18 and 24 in. are standard. The largest size machine has a capacity for punching a $2\frac{1}{2}$-in. hole through a 1-in. steel plate, and plates up to $1\frac{5}{16}$ in. thick can be split. Throat depths of 15, 24, 36 and 48 in. are furnished. The entire range of machines is especially suitable for motor drives, with the motor mounted on top of the frame so that only a limited floor space is required.

The automobile electric control makes it unnecessary for the operator to leave his position in front of the machine to start or stop the operation. The push-button switch is portable and may be operated by either hand or foot. The clutch is of the solid jaw, renewable-face type. The sliding half is a steel casting and the fixed half is a part of the large gear and is reinforced by a steel ring shrunk into place. This clutch disengages in case the electric current fails, as a safety measure.

When making the adjustment for the length of stroke, the cap shown on the front of the head is turned to the adjusting position so that the electric circuit is opened and the clutch disengaged. The adjustment is then made by positioning around the cap a headless setscrew which is exposed. The point at which the stroke will end can be easily predetermined. Depression of the pushbutton by hand or foot causes the clutch to engage and the head to descend to the predetermined point. The head then rises and stops.

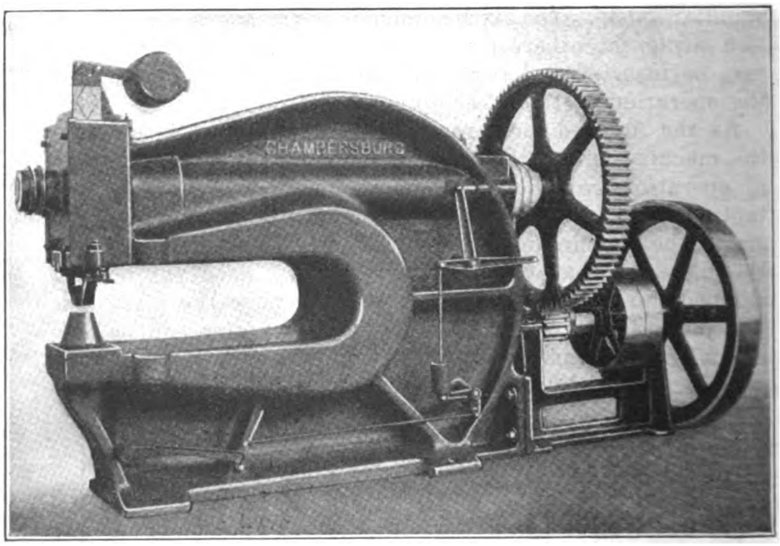


FIG. 2—CHAMBERSBURG MECHANICAL CONTROL PUNCHING MACHINE

Keller Type F Automatic Die-Sinking Machine

The automatic die-sinking machine shown in Fig. 1 is designated as the Type F and has recently been placed on the market by the Keller Mechanical Engraving Co., Brooklyn, N. Y. The machine is intended for work in which impressions up to 36x20 in. and 8 in. deep must be made, and is adapted to the manufacture of forming, stamping and forging dies as well as metal patterns and core boxes.

The machine is intended for smaller and lighter work than the Type BG machine described on page 389, Vol. 55, of *American Machinist*. Since the Type BG machine carries work of very large weight, the work remains stationary and all movements are made in the head carrying the spindle and tracer. The Type F machine is different, because of the moderate size of the work. The horizontal movement is in the work table, which is provided with a range of speeds for cutting as well as a quick-return movement in each direction. The vertical movement and the in-and-out or transverse movement are in the head. Lead screws operate all the movements. There is also a contouring movement, so that a templet, ridge or groove in the pattern can be followed.

The control of all movements is electrical, as regards both the automatic feed and the pushbuttons employed for hand control. The control cabinet contains all of the mechanism necessary for the complete control of the movements. Although the illustration shows the machine equipped with the control board and an angle plate fixture, the control cabinet, which is a separate unit, is not shown.

The machine works from a master, which it reproduces. This master can be of plaster, cement or wood, as only a very slight pressure of the tracer is exerted upon it. However, all the required pressure is applied to the cutting tool, so that large cutting power as well as accuracy in reproducing the patterns can be obtained. The arrangement of the master and the work when cutting a steel die for an automobile front axle is shown in Fig. 2. The work leaves the machine in practically the finished condition, so that only a small amount of handwork is necessary to completely finish it.

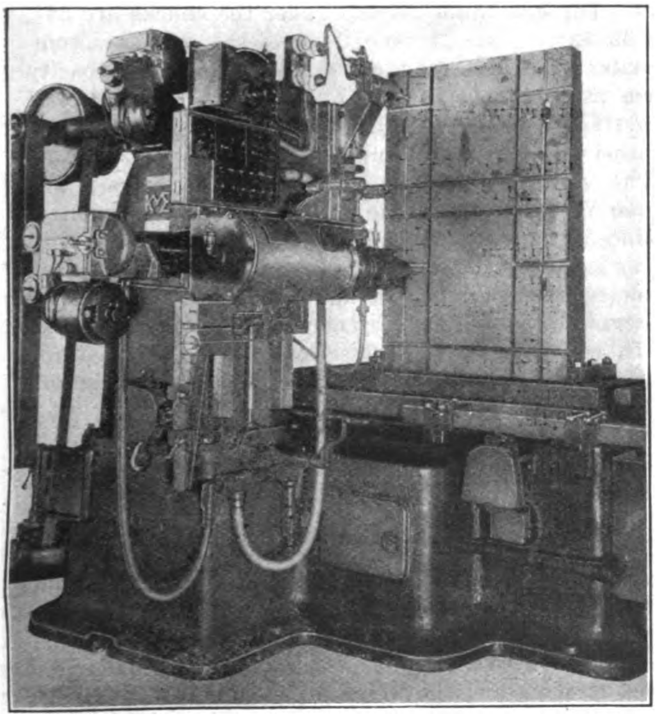


FIG. 1—KELLER TYPE F DIE-SINKING MACHINE

The table has a working surface of 53x22 in. It is provided with T-slots and an oil channel around its edge. Its horizontal travel is 36 in. and speeds from

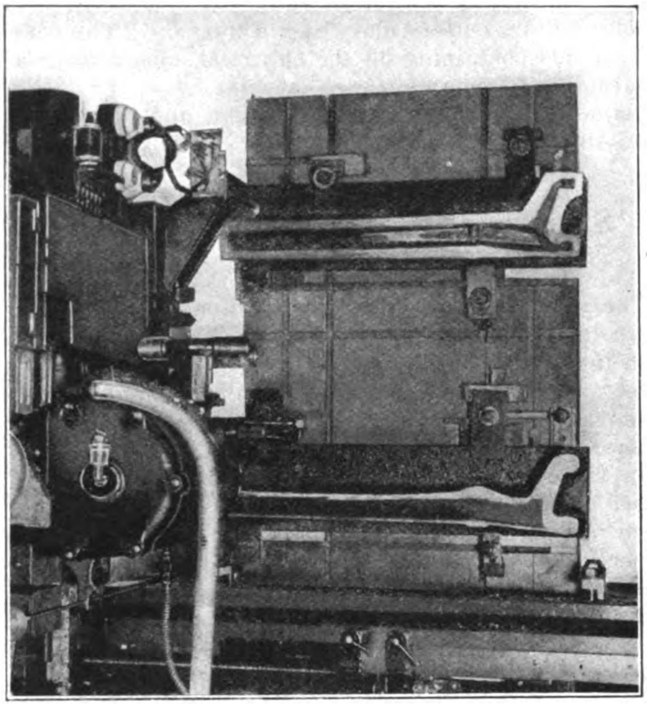


FIG. 2—WORK AND MASTER ON KELLER TYPE F MACHINE

1½ to 12 in. per minute are obtainable through rheostatic control and change gearing. The slide carrying the spindle has a vertical travel of 20 in. on the head; the rate of speed varies from 0.01 to 0.83 in. per stroke. The slide is counterbalanced. The transverse movement of the head is 8 in. This movement is electrically controlled so that the tracer can follow the impression of the master. All the moving slides have large bearing surfaces and are provided with tapered gibs, so that wear can be taken up.

For the purpose of following an outline templet in one plane, there is provided a contouring attachment similar to a profiling attachment. The device is controlled by a pushbutton and follows the outline whether it be inside or outside. The automatic and semi-automatic controls make the machine adaptable to a great variety of operations in which forms must be accurately cut.

Two separate motors are provided, one being a variable-speed motor of ⅝ hp. for controlling the various movements. A 2 hp. d.c. motor for 110 or 220 volts is directly connected to the lower cone-pulley shaft mounted on the rear of the column. The spindle driving pulley is carried on the upper cone-pulley shaft. Two separate spindle driving pulleys, as well as two spindles, one for slow speed and one for high speed, are provided. The slow-speed spindle has the back gears mounted as a unit on the spindle head. The high-speed spindle is driven by means of a grooved pulley from the pulley shaft of the slow-speed spindle. The slow-speed spindle runs in adjustable bronze bearings and is equipped with a No. 9 B.&S. taper; the high-speed spindle has a No. 7 taper. A range of speeds from 80

to 3,636 r.p.m. is obtainable by the two arrangements.

The spindle and slide are lubricated from a multiple sight-feed cup located on the spindle head. Coolant is supplied to the cutter by a force-feed, gear-driven rotary oil pump. The tank for the coolant is provided in the base, so that the coolant drains into it from the trough in the table.

The machine is complete with the motors, tracer points, milling cutters and other equipment. The control cabinet containing all the electrical apparatus is a separate unit connected to the machine by wiring. The machine is about 6 ft. 8 in. in height, and occupies a floor space of 9 ft. x 8 ft. 1 inch.

Sigourney High-Speed Ball-Bearing Sensitive Drilling Machine

The Sigourney Tool Co., Hartford, Conn., has brought out a line of high-speed sensitive drilling machines of both the column and floor types and having single, two, three and four-spindle heads. The single-spindle floor-type machine is shown in Fig. 1; the same style of head is used upon all the machines.

In these machines the spindles are completely enclosed by telescopic sleeves to prevent oil from being thrown upon the work or operator. The projecting upper end of the spindle is also enclosed in a stationary removable sleeve.

The spindles run upon Norma ball bearings and are capable of being driven at a speed of 4,000 r.p.m. without shock or vibration. At a speed of 900 r.p.m. of the first countershaft, the corresponding spindle speeds are 950, 1,600 and 3,000 r.p.m. The spindle driving pulley runs upon ball bearings that are independent of those of the spindle, and it also is enclosed by a hood that is permanently a part of the head bracket. All bearings are standard commercial ball bearings and are conveniently adjustable so as to keep them tight in service.

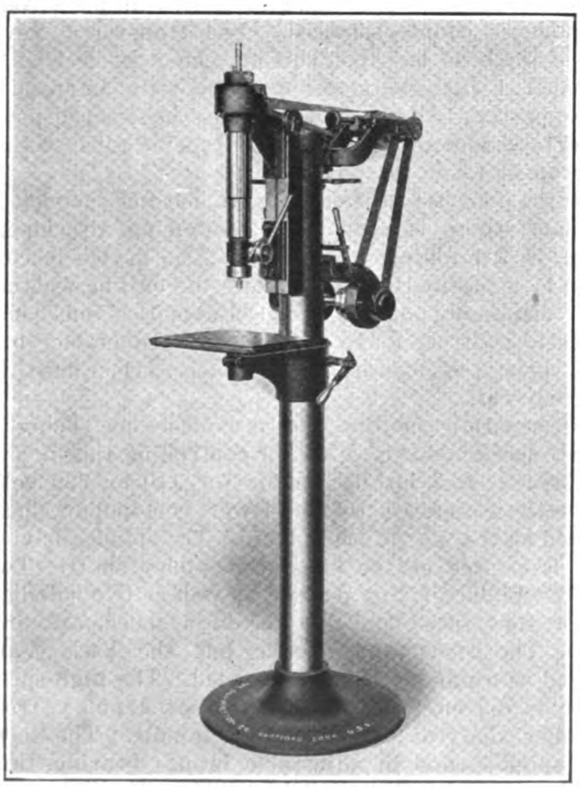


FIG. 1—COLUMN TYPE OF HIGH-SPEED SENSITIVE DRILLING MACHINE

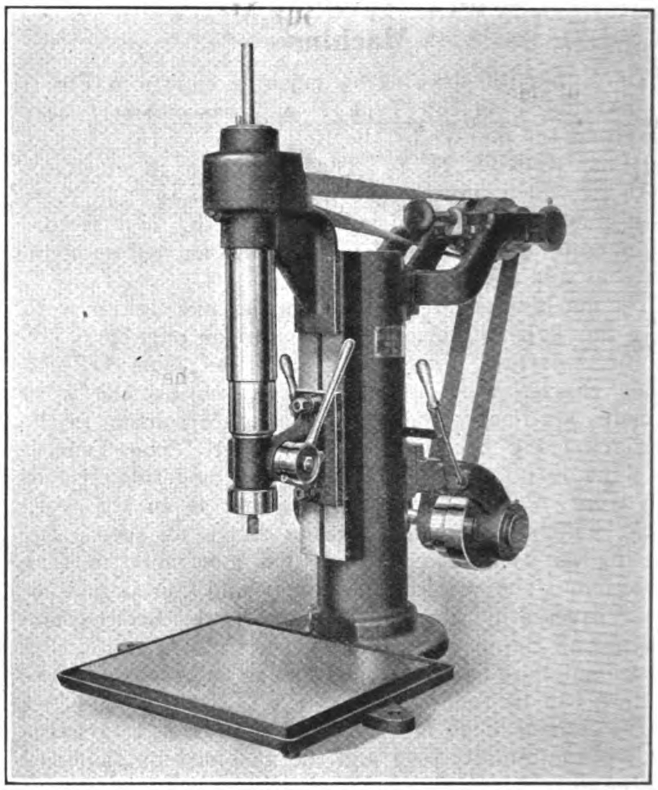


FIG. 2—NO. 1 HIGH SPEED BENCH DRILLING MACHINE

The table may be moved vertically on the column for a distance of 30 in. (33 in. in the single-spindle machine) and is balanced by a counterweight inside the column. A planed line upon the column and a witness mark on the table facilitate setting the hole in the latter in exact alignment with the spindle.

The table dimensions are 9½ by 12½, 12 by 25, 12 by 31 and 12 by 37 in., respectively, for the one, two, three and four-spindle machines. The heads are adjustable vertically upon the face of the brackets for a distance of 6 in. The maximum heights under the chucks are 34½, 32, 32 and 31 in. A taper hole in the spindle accommodates a No. 1 Morse taper shank. The rated capacity when using chucks in the spindles is $\frac{5}{16}$ in. drills. If larger sizes are desired, drills with taper shanks should be used directly in the spindles.

The vertical movement of the spindle by rack and pinion is $2\frac{5}{16}$ in. and the moving parts are counterbalanced by a concealed coil spring. A clamp stop with a knurled screw for fine adjustments is provided on each head. All belts are endless and the tension of each may be regulated individually by moving the second countershaft, conveniently located screws being provided for this purpose. Chucks, V-blocks, point and bell centers are furnished as extras.

The net weights are 400, 625, 765 and 960 lb., respectively. Boxed for export the machines weigh 600, 860, 1,090 and 1,360 lb., occupying a space of about 37, 45, 58 and 66 cubic feet.

The same type of head is also applied to the No. 1 bench drilling machine shown in Fig. 2, the specifications in the matter of speeds, adjustments and measurements being the same except that the table of the bench machine is 11 by 14 in., the maximum height under the chuck is 8 in., and the weights, net and boxed, are 215 and 360 lb., respectively. The space occupied by this machine when boxed for export is 19½ cubic feet.

Bausch & Lomb Contour Measuring Projector

A contour measuring projector by means of which gages, threaded work, gears and form cutters may be inspected, has been placed on the market by the Bausch & Lomb Optical Co., Rochester, N. Y. With the instrument, all sorts of small parts can be inspected for contour, and after heat-treating can be checked to detect distortion.

The equipment does not require a dark room for operation, as the image is produced on the horizontal table supported on the front leg of the stand. A curtain drapes the table to exclude the light of the room, as shown in Fig. 1. As the screen is attached to the instrument, any inaccuracy from the vibration of the screen alone is eliminated. Leveling screws are placed in the base so that, when in use, the base may be lifted off the castors.

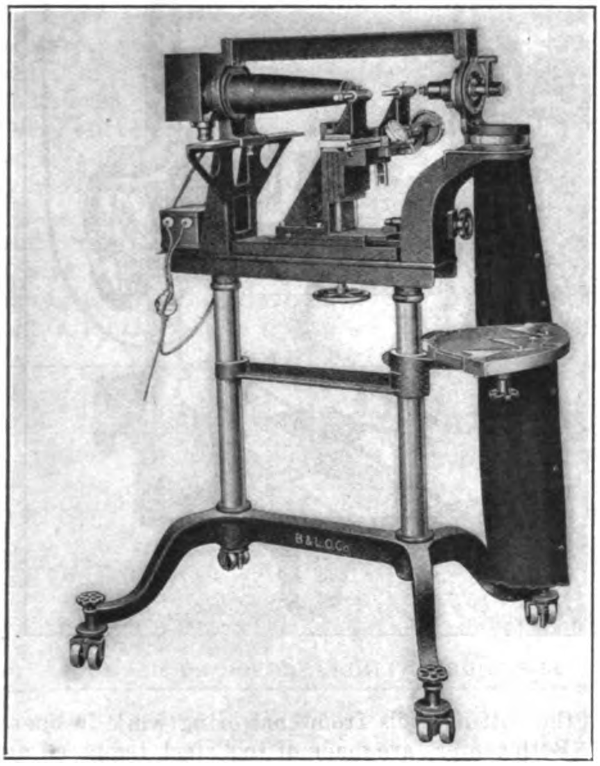


FIG. 1—BAUSCH & LOMB CONTOUR MEASURING PROJECTOR WITH ADJUSTABLE THREAD CHART AND LEAD MEASURING ATTACHMENT

The work carrier is a compound slide which may be given three movements by screws with handwheels. One handwheel controls the vertical and one the lateral movement to bring the work into position, while the third produces a movement toward or away from the objective for focusing the image on the screen. As a pair of V-blocks with adjustable centers is part of the equipment, the work may be held between centers or may be supported by the V-blocks. The adjustable thread chart, lead measuring device, screw holder, gear attachment, two opaque attachments, photographic plate holder, and angle plate are devices that can be furnished for attachment to the instrument.

A special concentrated, single-filament, 6-volt, 108-watt, Mazda lamp, operating in conjunction with a transformer on an alternating current is regularly supplied. For extremely critical work, the "Tungsarc" lamp is recommended for use when projecting gear contours at high magnifications, or inspecting spiral gears by reflected light. The light condensers are mounted in a cone which keeps them always in optical alignment. The iris diaphragm allows the diameter of the beam to be reduced as required. If desired, the prism reflecting the light down on the table and forming an enlarged image, can be swung out of the way on an arm, so that the light is projected straight ahead on a vertical screen. The optical system is fixed, and focusing is brought about by moving the object back and forth.

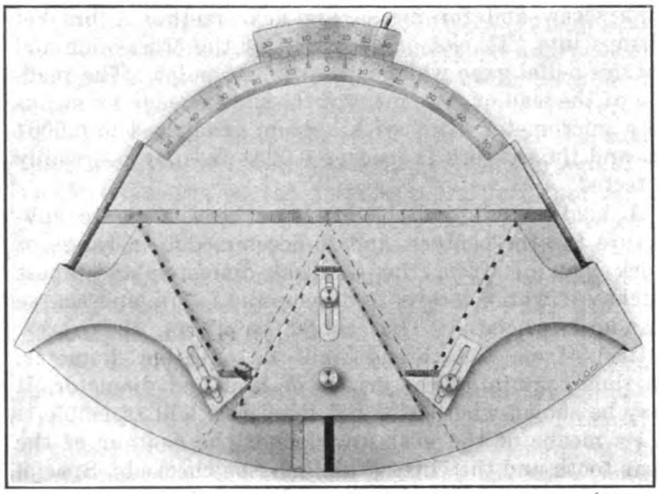


FIG. 2—ADJUSTABLE THREAD CHART

In the regular equipment are two focus objectives, a 24-mm. special objective in a long tapering mount of small diameter to work over the top of large diameter gages or threads, and a 48-mm. objective where less magnification or a larger field is desired. Eye-pieces of 5 X and 12.5 X for projecting threads up to 3 T.P.I. U.S.F., and gears up to 12 diametral pitch are also included in the equipment. By lowering the table and thus increasing the projection distance, greater magnifications can be obtained. These magnifications, however, vary slightly with different objectives and eye-pieces and are not for use in taking direct measurements.

When projecting threads, the entire optical system is at all times lined up along a single central axis. The light source, the condenser, the portion of the screw to be projected and the objective are always part of a single coaxial system, and the screen receiving the image is always perpendicular to the axis of this system. Where the helix angle is large, the flank angle can be determined by calculation.

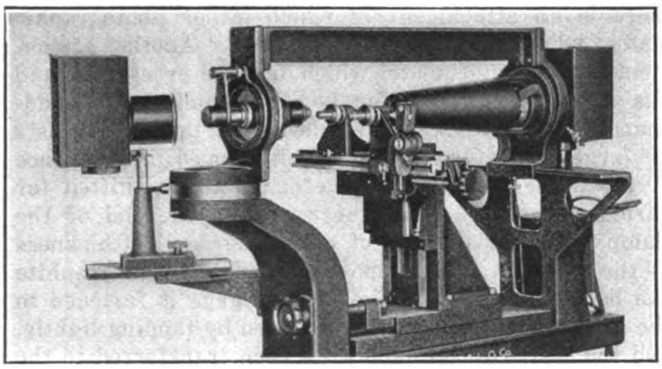


FIG. 3—CONTOUR MEASURING PROJECTOR WITH GEAR AND OPAQUE LOW-MAGNIFICATION ATTACHMENTS IN POSITION

The adjustable thread chart, shown in Fig. 2, is for very accurate measurement of threads. It has a graduated arc and vernier for checking the "lean" of threads and adjustable straight-edges which may be set by means of scales for any pitch and flat on the root of the thread, with a magnification of any desired value. It is set upon the table as shown in Fig. 1 and the contour of the threads is projected upon it.

The lead measuring attachment shown in Fig. 1 attached to the work-holding slide, is for checking the lead of a screw and for measuring gear teeth. A bracket clamps in a "T" slot on the front of the cross-slide and carries a dial gage which acts as a zero point. The reading of the lead or movement of the slide is made by means of a micrometer fitted with a drum graduated to 0.0001 in. and thus errors in lead of 0.0001 in. may be readily detected.

A holder and pitch blades have been made to substitute for the centers, and to accommodate a range of work varying from the smallest diameter and finest pitches of watch screws to diameters of 3 in. and coarse standard pitches. The holder supports the screw entirely from the thread walls or effective diameter. In thus combining the errors of lead and diameter, it may be shown whether or not the screw will assemble.

By means of the gear attachment the contour of the gear tooth and the cutting tool may be checked. Special adjustable brackets with $\frac{1}{2}$-in. diameter studs support the gears while an indexing pivot indicates the errors, tooth by tooth, over a number of teeth. By rotating the gears at an even rate, the rolling and sliding action of the teeth may be observed. In Fig. 3, the brackets and pivot are in position on the work carrier. Measurements of thickness and height of teeth can be taken to close limits with the lead measuring attachment.

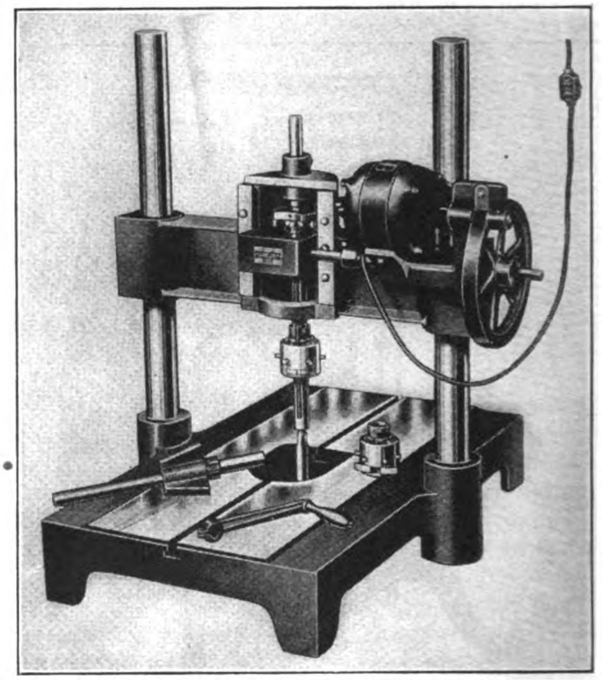
In measuring spur gears, the light may be passed along the tooth; but for spiral gears it is necessary to illuminate the work by oblique or normal illumination directed against the surface of the work being examined. Fig. 3 also shows the arrangement of a device for illuminating by oblique light. It is composed of a lamp house containing a 6-volt, 108-watt Mazda lamp fitted with a condenser, and is mounted on an optical bed. This arrangement can be used only for low-power objectives. The opaque attachment is for examining very small parts requiring high power objectives. The device, which consists of a vertical illuminator attached to the nosepiece of the optical tube, provides illumination normal to the surface under examination. With this attachment a 5-amp. arc lamp is substituted for the 6-volt Mazda lamp.

It is possible to take photographs of the image projected on the table and for use in this connection there is an attachment in which either photographic plates or bromide paper may be placed. Another attachment is the angle plate, which fits the cross-slide and has a clamping block for holding small flat or odd-shaped pieces in place, and a device for taking the casts of large diameter rings. Holes tapped in the face of the angle plate permit the clamp to be shifted for various diameters while the screw on the end of the clamp regulates the height according to the thickness of the ring. A cast composed of sulphur and graphite can be easily poured while the ring gage is fastened to the angle plate. The ring is loosened by tapping lightly, and the cast with its support is then transferred to the projector, where it is positioned properly in the V-block by a key on the support for the cast.

"Superior" Cylinder Reboring Machine

A machine for reboring automotive cylinders and designated as the "Superior" reboring machine, has recently been placed on the market by the Production Machinery Co., Jackson, Mich. The machine, which is shown in the illustration herewith, is of rigid construction and will handle any automobile motor cylinder or other internal combustion engine cylinder of similar design.

The machine consists of a bed-plate, to which the cylinder is clamped, and a cross-rail which carries the working parts. The boring bar is held between two centers, which prevents any deviation of the cutter from true alignment due to hard or soft spots, ports and clearances. It is stated that the construction also prevents the cutting tools from chattering while in operation. Both centers are made of tool steel, tempered and ground.



"SUPERIOR" CYLINDER REBORING MACHINE

The cutterhead is rigidly constructed, which also tends to insure perfect alignment where cylinders are out of round so that more metal must be removed from one side of the cylinder than the other. The cutter contains six blades, which are adjusted simultaneously by operating a hand wheel. All blades are made of high-speed drill rod and carefully tempered. They are ground to form a left-hand helix, which tends to draw away rather than into the metal. The machine is furnished complete with two cutter heads, which makes possible a range of from $2\frac{13}{16}$ to $4\frac{1}{8}$ in.; blades larger than this can be furnished if desired.

To locate the cylinder for boring, the bar shown lying on the table of the machine is placed between the centers and the locater is lowered into the top of the cylinder, where it is locked with a thumb-screw. This arrangement holds the cylinder in position until it can be clamped to the table by means of a T-bolt, after which the boring bar is substituted.

One of the features of the machine is the feed mechanism. Four different feeds are available by simply changing the position of the rollers with which the star

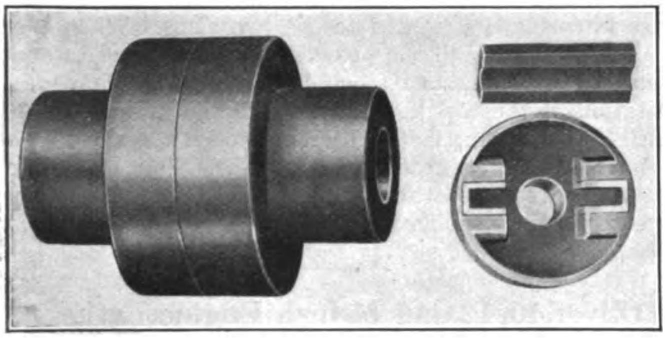
wheel comes in contact. Both the rollers and star wheel are hardened. The boring bar is driven by hardened steel helical gears, producing an even, constant feed.

The machine can be furnished either with an electric motor, as shown, or with pulleys for belt drive. The electric-driven machine is equipped with a ¼-hp. standard G. E. motor, for either 110 or 220-volt alternating or direct current, with cord and plug for connecting to a light socket, and a G. E. thermal switch which protects the motor.

"Tilting-Bar" Flexible Shaft Coupling

The "Tilting-Bar" flexible coupling recently developed and placed on the market by the American Foundry & Manufacturing Co., Frederick, Md., is shown at the left of the accompanying illustration. The coupling consists of only three parts, two flanged hubs with sockets in their faces and a steel bar that fits into the sockets. On the left of the illustration one of the flanges and the bar can be seen. Flexibility is obtained by the tilting and sliding of the bar in its sockets, so that parallel, angular and endwise misalignment of the two shaft ends can be accommodated.

Except for very slow-speed drive, the sockets are bushed with leather to furnish electrical insulation and to give quietness of operation. These bushings are impregnated with paraffin to make them water-proof and to lubricate the surfaces. The driving is done



"TILTING-BAR" FLEXIBLE COUPLING AND PARTS

through solid metal parts which are not subject to appreciable deformation, so that breakdown is not as apt to occur as when a number of springs and rubber pads are employed.

Due to the shallow V-shaped groove in the tilting bar there is a tendency for the two hubs of the coupling to move toward each other. The tilting bar is held centrally in one but is free to move endwise in the other. In this way the bar cannot be thrown out of center so as to cause a loss of balance and consequent vibration of the machine.

The factor of safety of the coupling is stated to be as high as 12, so that the shafts themselves would be twisted before the coupling would be broken. Due to the perfect balance, the coupling is suitable for the connection of shafts running at high speed. Parallel misalignment from 1/16 in. in the smaller sizes to ⅛ in. in the larger sizes can be compensated for. Angular misalignment of 7 deg. can be accommodated. Endwise motion, such as the float of an armature, is allowed also.

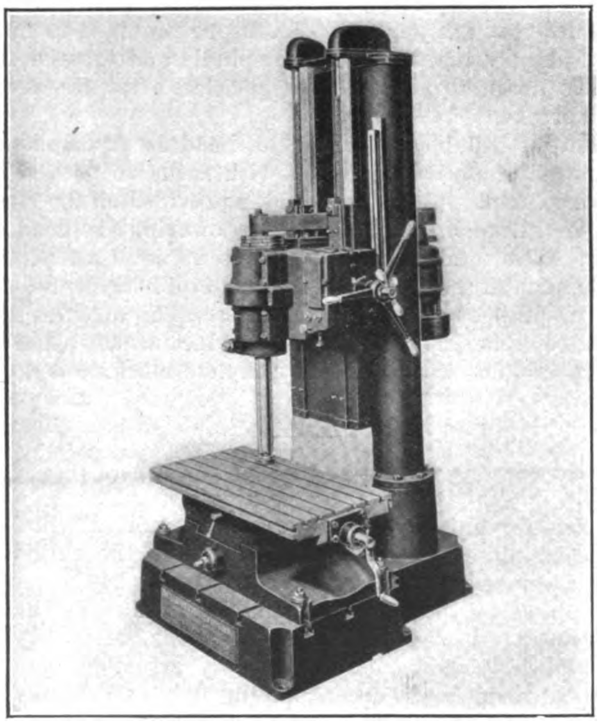
The coupling is ordinarily fastened to the shaft by means of one setscrew on top of the key and another at right angles to it. There are no projections on the outside of the flanges. The standard sizes in which the couplings are made are for shafts ¾ to 6½ in. in diameter, although couplings for larger shafts can be furnished on order. The weight of the smallest size of coupling is 3 lb., while the weight of the largest is 1,080 pounds.

Williams Vertical Cylinder Grinding Machine

The Hy-Way Service Co., 225 South St. Joseph Street, South Bend, Ind., has recently developed and placed on the market the Williams cylinder grinding machine that is illustrated herewith. The machine is of the vertical-spindle type, so that the work lies on the horizontal table with the cylinders vertical. One advantage of the vertical position of the spindle is the fact that all the driving mechanism is located above the grinding wheel, so that the abrasive dust drops down through the cylinders and does not settle on the bearings and running parts. It should be noted that the vertical ways on which the head slides are protected by a canvas curtain.

The longitudinal slide of the table provides sufficient movement for positioning the work under the spindle to grind three cylinders on either side of the center without uncovering the ways of the slide and exposing them to the abrasive dust. After the work has been clamped on the table in approximately the correct position, it can be located under the spindle by the longitudinal screw and by the transverse screw operated from the front of the machine. The table mechanism with its movements is a separate fixture mounted on the base of the machine. The finished top of the table is 28 in. long and 18 in. wide.

The entire mechanism for driving the wheel is mounted on the wheelhead, which slides on the two widely spaced ways on the vertical double column. A 2-hp. General Electric motor is carried on the back of the head and serves to counter-balance the spindle



WILLIAMS VERTICAL CYLINDER GRINDING MACHINE

mechanism. It performs three functions, namely, driving the grinding spindle at the high speed necessary for cutting with an abrasive wheel, transmitting the planetary rotary motion to the spindle unit, and feeding the head downward to advance the spindle into the cylinder and then returning it to the starting position.

The motor drives at both ends. At the top of it there is a pulley carrying a fabric belt to transmit power directly to the grinding spindle. The speed of rotation is varied to suit the size of the abrasive wheel employed by changing the pulleys on the motor and the spindle, the speed being usually from 5,000 to 7,000 r.p.m. The spindle is mounted in a sleeve located eccentrically in another sleeve, the rotation of which gives a planetary motion to the spindle. A bevel ring gear on the outer sleeve is connected with the driving mechanism, so that power can be applied to rotate the sleeves independently of the rotation of the grinding spindle.

The two sleeves in which the grinding spindle is mounted are so arranged that by making suitable adjustments the eccentricity of the spindle from the center of the spindle unit may be varied from zero to 1⅜ in. A graduated dial is provided to indicate the amount of eccentricity for any given setting. The range provided is sufficient for grinding practically all commercial sizes of automotive cylinders when grinding wheels of suitable size are employed, without the necessity of changing the pulleys. Holes as small as 2¾ in. in diameter can be ground to a depth of nearly 17 inches.

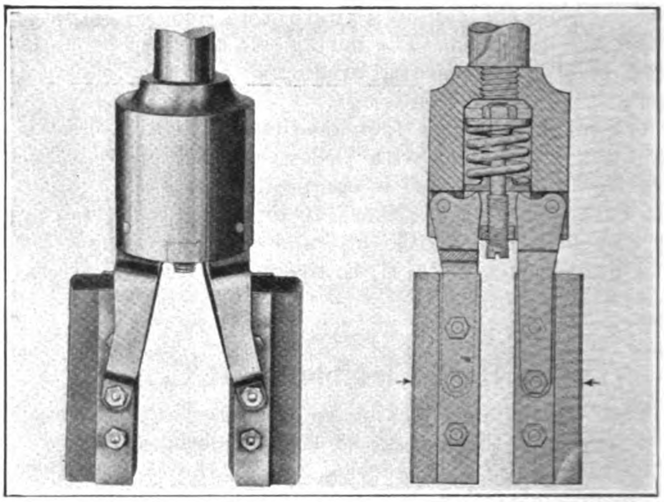
Power for imparting the planetary movement to the spindle is taken from a pinion at the lower end of the electric motor and carried through suitable gearing to the bevel ring gear on the eccentric sleeve. Two speeds of rotation are provided, one of 40 and the other of 60 r.p.m., obtainable through gearing and clutches by manipulating a hand lever on the left side of the machine.

The rate of feed of the wheel vertically into the work is susceptible to wide variation, as twelve rates of feed are available, ranging from 0.007 to 0.375 in. per revolution of the grinding spindle. All the changes are obtained through gearing. Stops are provided to limit automatically the travel of the spindle and to raise the spindle again to the starting position after its downward stroke.

The vertical operation of the head is accomplished by means of pinions meshing with racks on both sides of the column. A capstan wheel is provided on the right side of the machine for raising or lowering the head by hand. The total vertical travel is 28 in. All of the mechanism of the feed box runs in an oil bath, and oilers are provided on all sliding surfaces. The machine has an extreme height of 7 ft. and requires a floor space of 37x42 in. The weight of the complete machine is 4,000 pounds.

Storm Cylinder Finishing Tool

A tool for finishing the bores of automotive cylinders by polishing or burnishing action after the cylinders have been reamed, rebored or reground has recently been placed on the market by the Storm Manufacturing Co., 406 Sixth Ave. South, Minneapolis, Minn. This tool, which is shown both completely assembled and in sectional form in the accompanying illustration, may be driven by an ordinary drilling machine or by a special driving mechanism that can be furnished.



STORM CYLINDER FINISHING TOOL

The tool carries two abrasive stones of fine texture which rub against the bore when the tool is revolved, so that the surface is given a very smooth finish. The stones are held in contact with the cylinder wall by the action of the spring in the center of the body. The tension may be adjusted to suit different diameters of cylinders by turning the arbor in the center.

The spring is usually compressed to about 110 lb. pressure. This pressure is transmitted from the lower disk to the cams on the arms holding the stones. When the tool is perfectly centered in the cylinder, the pressure is evenly distributed to the two cams. When the tool is off center, all the pressure is transferred to one cam, so that only one stone bears against the work. Rotation of the tool naturally draws the driving block into such position that both stones touch the work and both cams are in contact with the disks. This centering action allows the tool to be operated at high speed. No universal joints nor flexible couplings are employed.

Oliver 10, 12 and 14-Inch Engine Lathes

To complete its line of engine lathes, the Oliver Machinery Co., Grand Rapids, Mich., has recently placed on the market 10, 12 and 14-in. sizes, so that machines ranging from 10- to 30-in. swing can be furnished. The lathe is made in both cone-pulley and geared-head, single-pulley types, a 12-in. size of the latter being illustrated. Straight or gap bed, bench or floor legs, oil pan and pump, and countershaft drive or motor drive can be furnished. The tool is for general use where an engine lathe for screw cutting is required.

The headstocks of the 10-, 12- and 14-in. lathes provide swings over the bed of 11, 13 and 15 in., respectively, and over the carriage of 8, 9 and 10½ in. The cone-pulley headstock is of the bowl type and has three steps. It is provided with single back gears, so that six speeds from 25 to 500 r.p.m. are provided.

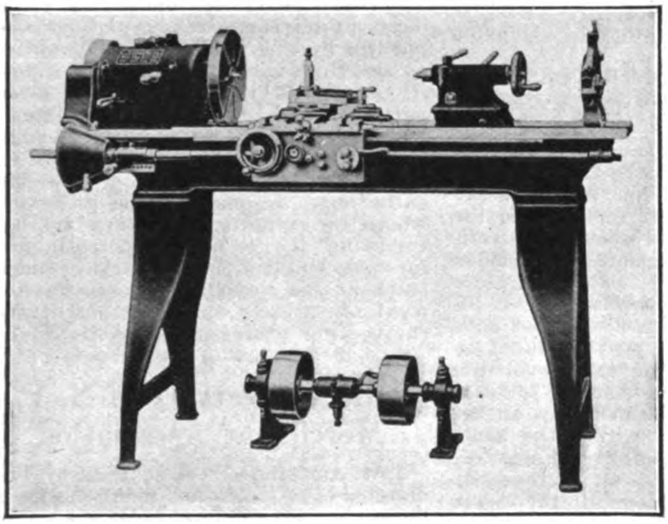
The single-pulley-drive geared headstock is fitted with steel gears that run in an oil bath. Six speeds ranging from 32 to 500 r.p.m. are obtainable by shifting two levers. A friction clutch is fitted in the driving pulley, so that the lathe can be started and stopped without the necessity of starting or stopping the motor or the driving belt.

The spindle runs in phosphor-bronze bearings adjustable for wear. In the two smaller sizes, a No. 2 Morse

taper is employed, and a No. 3 on the 14-in. size. The holes through the spindle are, respectively, 1, 1 1/16 and 1 1/4 in. for the different sizes of machines. The diameter of the spindle nose is 1 5/8 in. with 10 threads per inch on the 10- and 12-in. lathes, and 2 1/8 in. with 8 threads per inch on the 14-in. lathe. The tailstock has a screw-operated set-over for turning tapers. This set-over, as well as the spindle, is graduated in sixteenths of an inch.

The bed is provided with three V-ways and one flat way. The standard lengths are 4 ft. 3 in., 5 ft. 3 in., and 6 ft., the lengths allowed between centers with the tailstock flush being 25, 36 and 36 in., respectively.

The carriage has a cross-slide travel of 6 3/4, 7 1/4 and 8 in., respectively, for the different sizes. The compound rest of the 10-in. machine carries a tool 1/2 x 3/4 in. in size, while for the 12- and 14-in. machines, the tool-holders can be 1/2 x 1 1/8 in. The back of the carriage is machined and tapped, so as to receive a taper attachment for turning tapers up to 4 1/2 in. per foot.



OLIVER 12-INCH SCREW-CUTTING ENGINE LATHE

The apron gearing is so arranged that the operator may shift from thread cutting to either the longitudinal or the cross feed without the necessity of shifting gears. The two halves of the phosphor-bronze lead-screw nut can be closed on the lead screw only when the feed lever is in the neutral position, so that both the lead screw and one of the power feeds cannot be engaged at the same time. The lead screw is 15/16 in. in diameter and has five threads per inch. It is splined, so that the power feeds are operated by it.

The change-gear mechanism for the feeds is mounted on the left end of the lathe. The gears are slidably set on the end of the lead screw, so that they can be moved along to bring the proper one in mesh with the driving gear from the headstock. The range of feeds is from 0.0025 to 0.039 in. for all sizes of the machine, and all standard threads from 3 to 40 per inch can be cut. If desired, a small quick-change gear box can be furnished. The direction of feed may be reversed from the headstock without the necessity of stopping the lathe, reversing the direction of the spindle, or engaging or disengaging gears.

A countershaft can be furnished for either the cone-pulley or the single-pulley drive machine. The cone-head machine may be made self-contained by mounting a friction countershaft on a swinging arm at the rear of the headstock and fastening the motor on a bracket bolted to the leg. Means are provided for adjusting the tension of the driving belt. A countershaft may also be mounted for constant-speed-pulley drive, an arrangement that is applicable to the bench type machine. The geared-head machine may have the motor mounted directly on top of the headstock, or the motor may be mounted on the leg and belted to the driving-pulley.

A universal milling attachment can be provided for doing light milling work. A variety of attachments can be furnished, such as a follow rest, turret on either the carriage or the bed, draw-in attachment, chuck and metric lead screw and transposing gears. The regular equipment consists of large and small face plates, steady rest, compound rest, the necessary centers and a double friction countershaft.

The net weights of the three sizes of machine are 575, 875 and 1,300 lb. The boxed weights are 700, 975 and 1,400 lb., and the boxes have contents of 80, 90 and 100 cu.ft.

Test Questions for Hiring Employees —Discussion

By S. N. Bacon

Referring to page 141, *American Machinist*, Mr. Robert Grimshaw makes a suggestion for hiring employees which the writer does not believe would work out to very good advantage. Mr. Grimshaw would have us question the applicant as to whether he could operate a "Broynton" milling machine and if he replied yes, it would prove that he was not a milling machine operator or was at least unreliable. The writer believes the question is just as unfair as the answer and has in mind a period some years ago when he was considered a fairly good screw machine operator, experienced on Brown & Sharpe, Cleveland, Acme, Hartford, and Gridley automatic machines. Had the question been asked can you operate a "Broynton" screw machine he would have answered "yes" not because he would lie due to lack of experience but because his knowledge and experience of all the leading makes gave him enough confidence to tackle a machine he never heard of before. His experience on the Acme and Brown & Sharpe screw machines qualified him to operate a Universal screw machine without any previous experience.

A milling machine is composed of just so many standard operating parts and, if an applicant has had several years experience on Universal, Lincoln type and automatic milling machines, similar to the Pratt & Whitney, he is certainly justified in saying he can operate a Broynton or any other make. Another practice, which has been adopted by employment managers, while not exactly unfair, is at least an attempt at deception in advertising and is contrary to law in some states. This is the practice of inserting two advertisements and using different box numbers when the intention is to employ but one man for a particular job. The advertisements are worded differently so as to trap the applicant into writing two different letters of his experience. Chances are the applicant has really had all the experience claimed but it is not always to advantage to tell it all in an application for a special line of work. In these days of unrest let us use fair methods in securing employees and be that much surer of obtaining the best and lasting results.

News Section

Advancement in Mechanics To Mark National Exposition

The National Exposition of Power and Mechanical Engineering will open at 1:00 p.m. on Thursday, December 7, 1922, at the Grand Central Palace. It will immediately follow the Annual Meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers and will remain open until December 13th, except on the intervening Sunday.

This Exposition will be the first large scale attempt to display mechanical and power plant apparatus so that the present extraordinary state of development will be apparent not only to the highly trained technical man but to the layman with little knowledge of the severe problems involved in the engineering design and operation of combustion apparatus and power-generating machinery. A very small percentage of the individuals in the world are informed about the tremendous importance of the engineering arts and sciences to our present civilization.

A detailed program of the Exposition as well as the programs of the A.S.M.E., A.S.R.E. and A.S.S.E., meetings will be announced in these columns at an early date.

American Foundrymen's Convention Announced

According to an announcement just received from C. E. Hoyt, secretary, the next annual convention of the American Foundrymen's Association will be held in Cleveland, April 30 to May 3, 1923.

In conjunction with the convention, there will be held an exhibition of foundry and shop equipment which, according to present plans, will take place in Cleveland's new public auditorium where, also, will be held the convention.

Work is already under way on the program which will be announced in full in these columns at a later date.

Tennessee Central Shops Destroyed by Fire

Fire of unknown origin, but believed to have started from oil ignited in the boiler room, destroyed the main shops of the Tennessee Central Railway, located near the corner of Hermitage and Fairfield Aves., South Nashville, Oct. 27, entailing a loss estimated at between $400,000 and $500,000. Insurance will cover part of the loss.

Originating in the room where the huge stationary engines are located for operating machinery in the various shops, the flames spread to every section of the big building, covering approximately one acre of ground. Located in the building were the machine shop, tin shop, tool rooms, planing mills, blacksmith shop and boiler rooms.

Four large locomotives, three freight and one passenger, were destroyed. Thousands of dollars' worth of equipment, machinery, tools and materials of all kinds are a total loss. More than 30 box cars standing on a siding near the shops were partially destroyed.

Late advices reaching *American Machinist* indicate the construction at an early date of a modern fireproof structure to take the place of the buildings destroyed.

Car Shortage Increases 10,000 in 7 Days

Reports received today from the rail carriers of the country by the Car Service Division of the American Railway Association show that the demand for freight cars over and above the available current supply amounted to 166,349 cars on Oct. 23. This was an increase of 10,040 cars over the total on Oct. 15.

The demand on Oct. 23 for box cars in excess of the supply amounted to 81,734, an increase of 4,623 over the total on Oct. 15. The demand for coal cars totaled 46,575, which was an increase of 1,591 cars within the same period. A shortage of 21,004 was reported for stock cars, an increase of 2,085 since October 15, while there was an increase of 1,717 in the shortage of refrigerator cars which brought the total to 9,348.

Reports also showed that at the same time 4,409 surplus cars of all descriptions and in good order were scattered throughout the country, an increase of 134 since October 15. Of that number, 1,776 were surplus coal cars. This was an increase of 188 since that date.

400 American Firms in China

In view of the recently approved China Trade Act, by which Congress has placed American firms operating in China on an equality, for the first time, with British, French and Japanese firms in the matter of taxation, the following tabulation of foreign firms and persons doing business in China is of especial interest. It has been received by the Department of Commerce from supposedly reliable sources in Shanghai:

	1914		1921	
	Firms	Persons	Firms	Persons
American	136	4,365	412	8,230
British	534	8,914	703	9,298
French	113	1,864	222	2,453
German	273	3,013	92	1,255
Japanese	955	84,948	6,141	144,434
Russian	1,237	56,319	1,613	68,250
Non-Treaty Powers	5	95	14	193
All others	68	2,289	306	3,653
Total	3,421	164,807	9,511	240,769

It will be noticed that the number of foreign persons has decreased from 351,000 to 240,769 since 1920. This decrease, however, resulting from the 1920 depression, is probably a healthy sign, for those who have weathered the storm are in the strongest position.

Reports Great National Interest in Technical Service

L. W. Wallace, executive secretary of the Federated American Engineering Societies, has completed a coast-to-coast tour, during which he set in motion plans for Federation expansion. Stressing the great influence exercised by the Federation since its organization about two years ago under the presidency of Herbert Hoover, and evidencing this by the report of its Committee on the Elimination of Waste in Industry, as well as by the report of the Committee on Work Periods in Continuous Industry, as well as by other sustantial achievements, Mr. Wallace was attentively heard by large engineering gatherings in many cities. Everywhere, he reports, engineers are recognizing the enormous potentialities for technical and public service which reside in the Federation as the instrument of expression and action of the engineering profession in America.

25th Anniversary of N. Y. Merchants' Association

Invitations have been sent out by The Merchants' Association to all business houses in the city which have been in business uninterruptedly for one hundred years to send representatives to the mass meeting which will be held at Madison Square Garden on Nov. 17 to celebrate the twenty-fifty anniversary of the Association. If Mrs. Harding's health permits him to leave Washington, President Harding will address the meeting. While many houses have suffered changes of title during a century of existence, it is believed that a considerable number exists in the city.

Car Loadings Establish Record for 1922

A total of 1,003,759 cars were loaded with revenue freight during the week which ended on October 21, according to reports received today from the rail carriers by the car service division of the American Railway Association.

This was the largest number of cars loaded during any one week in two years. This also was within 14.780 cars, or one and five-tenths per cent of the greatest loading in the history of American railroads, which took place during the week of October 15, 1920.

The total for the week has only been exceeded four times in history, all of which took place in the fall of 1920 and are as follows:

September 24... 1,008,109
October 8...... 1,011,666
October 16..... 1,018,539
October 27..... 1,008,818

Loading for the week of October 21 this year was an increase of 20,289 cars over the preceding week.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

THE price movement on the New York Stock Exchange is a factor in our economic complex that the American business man cannot ignore. There are 2038 daily newspapers in the United States. Of these a large majority publish the Stock Exchange quotations and whenever the fluctuations are at all unusual or sensational attention is called to them with "scare heads."

The result is that business sentiment from the Atlantic to the Pacific is more or less attuned to the ups and downs of Wall Street, whch are often otherwise unimportant. This is to be regretted, but it is a fact that we cannot disregard. Attention is called to it because the prevailing commercial optimism seemed to be somewhat chilled early last week by the continued decline in the stock market.

This decline, which had been in progress since September, seems to have culminated temporarily at least, on last Monday. On that day 478 different stocks were traded in on the Stock Exchange and some of them sold 20 or 30 points below the high record of the summer. On Tuesday, when business men read their papers they commenced to say "We don't like the weakness of the stock market" and nearly all the commodity markets became reactionary. By Thursday the stock market had made a substantial recovery, the merchants who had become apprehensive were reassured and as the week ends confidence in the future seems to be completely recovered.

But the sympathy between the commercial and financial markets is not entirely logical. Almost without exception the trade reports are optimistic. If the predictions made are realized the banking resources of the country will be fully employed in financing the distribution of goods.

Moreover, gold is commencing to leave us. Since the 1st of October $17,000,000 has gone to Canada, as the Canadian dollar is slightly above par. The reserve ratio of the Federal Reserve System is slightly lower at 76 per cent, as compared with 77.6 a week ago, the gold on hand shows a decrease of $7,000,000 and the total of bills discounted has increased by $121,000,000. This all points to higher interest rates, which do not favor stock speculation. Therefore it is to be doubted whether the expected improvement in mercantile business will be permanently accompanied by a buoyant stock market. Railway securities may and probably will sell higher, but a renewal of liquidation rather than further buying of the highly speculative industrials seems to be indicated.

But of commerce and industry the converse is predicted and the outlook seems to justify the prediction. There is in the first place the theory of a secondary inflation. It is not yet generally excepted. Some influences are at work to prevent its becoming an actuality, but deflation is unpopular at present and the credit expension in progress is not likely to be arrested until the reserve ratios are much lower and the elation caused by high prices has carried the business community off their feet. This is unfortunate, but it is human and we may as well face the facts.

Meantime those who talk about inflation should remember that only three important raw products are as yet much above their prewar value. They are cotton, wool and paper.

The boll weevil has put cotton up and he will probably keep it up until some way to destroy him is found. Whether the advance will check the consumption of cotton goods remains to be seen. Some authorities fear it may, but thus far the domestic demand shows no signs of abatement and the export movement of raw cotton is again increasing. The advance in wool is directly due to the tariff, which is not likely to be changed for some years.

The demand for paper, which is really phenomenal, reflects the increased circulation of the newspapers as well as the growth of our reading and advertising habits. They are national characteristics that are likely to become more marked as each year passes.

As to the other staples—wheat, corn, oats, rice, sugar, tea, coffee, meat, iron, steel, copper, rubber, leather, lumber, building materials and petroleum—they are none of them in the raw state much above their prewar prices.

Roughly speaking, it is probable that in so far as the industrial classes are concerned their purchasing power and the cost of what they have to buy is closely equated, but this is not true either of the farmers or of clerical workers and it is from one or both of these groups that we shall probably hear the first effective protest against the rise in the cost of living now in progress. For it the careful merchant should be on the alert.

The "overall parade" that everyone ridiculed was the prelude to the "buyers strike" that commenced nearly three years ago and it may be that something equally trivial will be the signal for the next recessional of what we call prosperity.

There are other contingencies that should not be lost sight of. Tuesday's election and its effect upon the minds of the people and the policy of the government are to be considered.

The decline in the German mark to 1 13/16 cents a hundred, which seems to indicate that all hope of rehabilitating the credit of the German government has been abandoned, is another development that suggests caution.

Still another is the cost of coal to the small consumers in the large cities. It appears to be again rising to extortionate figures despite the vigilance of the various coal commissioners who have little or no legal power over the unscrupulous profiteers.

A high authority has enjoined us to "beware when all men speak well of you" and as an antidote to over-confidence this advice should not be forgotten in times of prosperity and expansion.

All the indicia of business are now favorable. Postal receipts, car loadings, railway traffic, the sales of mail order houses and department stores, bank clearings, the output of automobiles and most other statistics indicate an increased and increasing volume of business.

But these statistics have reference chiefly to the past and it is for the invisible and the unknown that we must make allowance. When we were in the depths of depression it was safe and wise to rely upon a return to normal, but now that we are getting into a higher altitude we should not foreget that there is a level at which the air becomes so rarified that breathing is difficult.

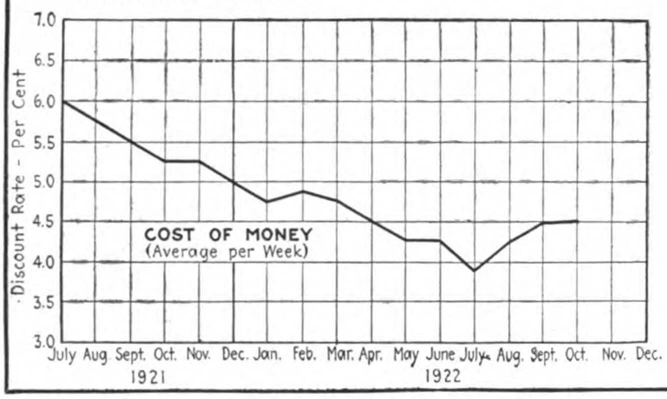
Big Year Ahead for U. S. Manufactures

American manufacturers are evidently preparing for an exceptionally busy season both in their domestic industries and the export trade. In fact, says the *Trade Record* of The National City Bank of New York, they are in many cases doubling their importation of raw material as compared with conditions a year ago, while on the export side manufactures are the one group of articles which shows an increase in exportation while other groups show a decline.

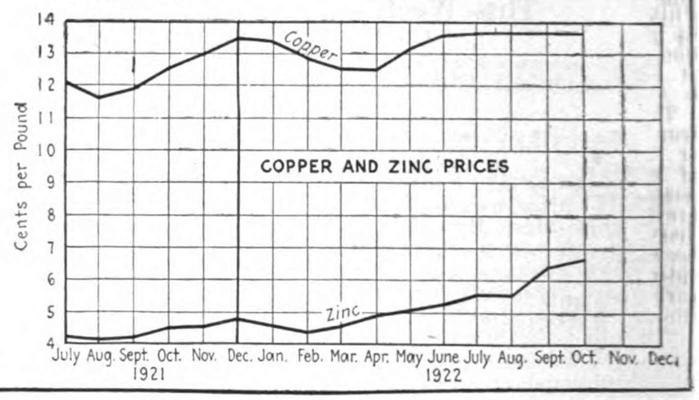
Manufactures exported in the month of August, the latest month for which we have official figures in this detail, showed an increase of 15 per cent in value when compared with the same month of last year, while the other articles exported showed a reduction of over 33 per cent in value in the same period. The few figures thus far received on September exports indicate that the record of that month will also show a heavy fall in exports of non-manufactured material, and probably an increase in manufactures exported.

The startling factor in the activities of the manufacturers at the present moment is in the tremendous increase in their importation of raw material. Practically every important article for which our manufacturers require foreign material shows a large increase in the quantities imported in August, 1922, when compared with those of August, 1921.

Average weekly rates for 60 and 90 day commercial paper based on daily New York quotations furnished by the Journal of Commerce.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.



COST of money as reported from the various points in the Federal Reserve System shows a firmer and higher tendency. City and country banks have been in the market for prime commercial paper and an excellent demand has been in evidence with fairly liberal offerings. The range in rates in October has been between 4¼ to 4¾ per cent as compared with an approximate range of 4 to 4½ per cent in the previous month.

Equipment shares fell off during the month from the high point reached in the middle of September, the average price of 10 representative issues dropping to $106.50 as compared with $110.40 in the month previous. The decline has been largely speculative in character with profit taking in evidence. There has been a feeling of caution manifest in various quarters with a disposition to look upon the market, as a whole, as having reached the end of the upward swing which started some months ago and which has been serenely under way since that time. Nothing at the present moment, however, indicates a drastic reaction.

Copper and zinc prices, on the average, show but fractional changes during October. The average price on the New York market for the former was 13.632 cents as against 13.748 cents in September. Zinc averaged 6.840, an increase from 6.110 cents. Buying at the present time is very dull both for domestic and foreign account. January deliveries are being named in copper, this years wants apparently being satisfied. In export an increased demand has developed from France. Zinc producers report an excellent demand with prices stronger and higher. Active European buying has been in evidence recently.

Comparative Prices of Shop Supplies

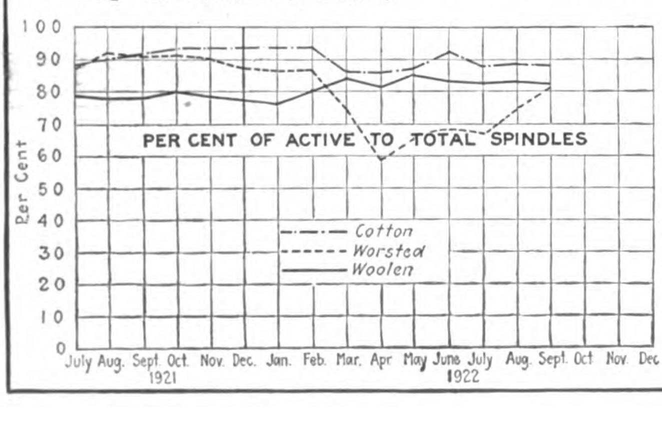
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0295	$0.0285	$0.0273
Cold finished shafting......	per lb.........	0.0378	0.0373	0.0379
Brass rods.....	per lb.........	0.171	0.1700	0.148
Solder (½ and ½)	per lb.........	0.23	0.228	0.20
Cotton waste..	per lb.........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	5.00
Emery, disks, cloth, No. 1, 6 in. dia........	per 100......	3.11	3.11	....
Lard cutting oil	per gal.......	0.575	0.575	....
Machine oil....	per gal.......	0.36	0.36	....
Belting, leather, medium......	off list........	40–5% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

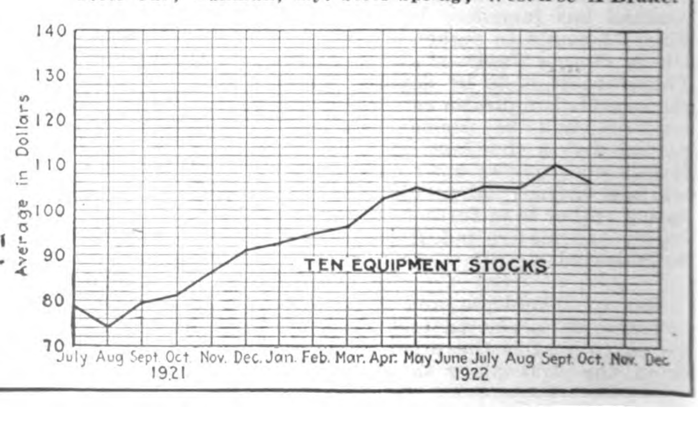
Textile industrial activity in the United States during the month of September compares favorably with the month of August, October figures not yet being available. Cotton spindleage active amounted to 89.8 per cent of the total in place as compared with 87.9 per cent in August. In the woolen industry there was a slight decline from 82.9 per cent to 81.7 per cent. Worsted conditions, on the other hand were better, active machinery amounting to 81.4 per cent of the total in place as compared with 74.8 in August. The demand for woolens and worsteds continues steady. Cotton yarn prices are strong and rising. Exports of cotton cloth continue ahead of last year.

Employment in industries, according to the Department of Labor, shows that in September as compared with August, there was an increase of 10 per cent in foundry and machine shops. Within the same period there was also an increase of 9.5 per cent in the total payroll disbursements and an increase of 0.5 per cent in per capita earnings. In the iron and steel industry per capita earnings increased 9.5 per cent, employment showing a slight decrease of 1.9 per cent. The electrical industry shows a 2.2 per cent increase while employment in farm implement manufacture declined 4.4 per cent.

Monthly percentage of active cotton, woolen and worsted spindles to the total in place as reported by the Bureau of Foreign and Domestic Commerce.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West'h'se A'Brake.



Business Conditions in Germany

Labor Still a Disturbing Factor—Steel Industry Shows Improvement—Tool Builders Operating on Part Time

By OUR BERLIN CORRESPONDENT

THE gradual decline of business, already noticeable during the first months of the summer, has, after a brief spell of revival, caused by the unprecedented money depreciation, taken sharp dimensions in the middle of September. The depression, signalled by a sharp falling off in incoming orders, has seized simultaneously nearly every line of industry and all stages of manufacture. Buying has nearly come to a standstill, not only with the ultimate consumers, but also with the whole chain of middlemen.

As a sign of the times there may be mentioned the almost complete failure of the last Leipzic fair in August, which started under the most favorable auspices. The numerous buyers it had attracted, have scurried away in haste after hearing prices and left the field practically to the salesmen. As a comprehensive test of market conditions, the Leipzic fair stands supreme. The lesson it teaches is, that prices have reached a level, upon which, at least the domestic market will not follow.

Fall of Mark Demoralizing

A general view of the situation shows, that the carefully preserved position, which Germany occupied in the matter of cost and labor in contrast to surrounding countries and the rest of the world, has been seriously weakened. In a discussion of German labor conditions, published in these columns, the situation has been likened to a vessel, allowing Germany to produce under a lower pressure of cost than in the rest of the world. There can be no doubt, that this vessel has now sprung a serious leak. Prices, which at first kept at a considerable distance from those of the outside world and were only slightly, and never immediately, influenced by exchange fluctuations, are now closely linked with the latter.

The paper mark has lost its capacity as a price unit and surrendered this position to the dollar. The growing tendency to substitute paper marks as a basis of prices by the dollar has, although strongly opposed in actual practice, established itself in virtue. The situation in this respect is one of extreme gravity. Prices are following almost instantaneously every upward move of the dollar exchange, but nothing short of a slump can effect their downslide. Almost the same can be said of wages. The distance, at which the cost of labor has been following the rise of living cost, has gradually diminished.

Apart from the seriousness of the labor question, the position of the industry has become very precarious in other respects. The chief difficulty is pronounced to be the shrinkage of working capital and the extreme tightness of credit. Recent visitors to Germany were greatly non-plused by the inability of the banks to cash checks of even small denominations. This was explained to the public as due to the printers' strike, a rather absurd explanation, remembering that this strike dated months back and lasted only 10 days. The fact is, that wages, salaries and other cost have risen so enormously, that the currency available has become insufficient. In many parts of the country factories could not pay their employees in full.

The situation will be understood, when considering that the whole floating debt of the country of 350,000 million marks is now only worth 900 million goldmarks in comparison to 6,000 million in pre-war times. The depreciation of the money has run far ahead of the inflation, and by compelling the latter to follow, it becomes stabilized in its turn, a very natural consequence.

TABLE I—GERMAN FOREIGN TRADE IN MACHINERY

For First Seven Months of 1922

	Imports			Exports		
Month	Tons	Value (Millions of Marks)	Price per Ton (Marks)	Tons	Value (Millions of Marks)	Price per Ton (Marks)
January	1,010	27	26,700	32,695	927	28,400
February	656	19	29,100	39,257	1,255	32,000
March	1,480	19,4	13,100	40,247	1,465	36,000
April	778	24,5	31,000	39,418	1,586	40.000
May	402	10,9	27,000	40,497	1,614	40,000
June	1,519	31,8	21,000	41,527	1,909	46,000
July	776	30,3	39,000	36,381	1,761	48,000

The iron and steel industry showed during August even increased business in comparison with July, caused by the rush upon the market for covering in raw material in view of the quickly rising price level. Shortage and lower quality of fuel have further reduced the capacity of this industry. Scarcity of ore compelled imports of pig iron to an ever increasing extent, which precipitated the rise of prices of machine building material. The last adjustment has decided upon the following maximum prices of iron and steel: cast iron 26,500 marks per ton, mild steel 29,200 marks per ton, ferro manganese 80 per cent 72,700 marks per ton. These prices are not firm, but keyed to the price of coke in such way, that for instance in the case of ferro manganese an increase of 2.70 mark per ton comes automatically in force for every mark the price per ton of coke increases. Of steel products, Siemens Martin bars have now arrived at 63,000 marks per ton, crude sheets from 70,000 to 75,000 marks per ton, gage sheets from 86,000 to 159,000 marks per ton.

Tool Builders Working Part Time

The labor gazette reports that a number of machine building factories had to reduce working time not only on account of shortage of raw material, but because manufacturers were unable to find the money required for buying sufficient stock. According to the labor gazette a general decline of the machinery market outlined itself quite clearly during August.

This is especially true of the machine tool building industry, which as a rule is the barometer of the whole machinery market. Reports from various factories in different parts of the country agree, that a certain slackening of business took place during August. The machine tool trade, which feels the pulsation of the market better and quicker than the works themselves, noticed this change at a considerably earlier date and was viewing the outlook with misgivings at the time when in factories an optimistic tone still prevailed. It is peculiar to note that the first complaints heard of diminishing orders concerned the export and not domestic business. Coinciding with the rapid drop of the mark, this is very significant.

The large amount of orders still in hand is sufficient to keep the machine tool industry employed for a time, varying between two and seven months according to different lines and quality of production. A certain reduction of delivery dates is already noticeable, but for leading makes and a number of lines, like automatics, universal milling machines and heavy tools, quotations are heard for no less than from 5 to 6 months. Standard tools, like lathes of current sizes and plain milling machines, can be frequently had from stock or booked for delivery in 4 to 6 weeks. This is not so much due to the recent slump, which has not had time yet to take strong effect, but to the largely increased output of such tools.

Difficulties in Financing

The complaints heard in other fields of the enormously high cost of production, making the financing of the orders in hand more and more difficult, are not so frequent in the case of the machine tool building industry, but by no means absent, especially amongst the weaker members of the fraternity. In addition to these, complaints are heard of considerable delays in the supply of raw material and even of shortage of labor, especially trained hands. The latter is the result of the labor policy, which has nearly equalized the payment of trained and untrained labor and caused the first to seek employment in better paid lines of work.

Prices of machine tools have continued on their upward move, as is indicated by the directions issued by the German Association of Machine Tool Builders. The increase thus directed over the prices of November, 1921, which were from 15 to 30 times above pre-war level, are the following: December, 37 per cent; January, 42 per cent; February, 61 per cent; March, 87 per cent; April, 143 per cent; May, 190 per cent; June, 225 per cent; July, 294 per cent; August, 460 per cent; September, 980 per cent.

As can be seen, prices are for the time being approximately ten times higher than those of last November or

from 150 to 300 times above pre-war level. For October a further large increase is imminent. Wages are following the rise of prices at a certain distance, but their movement is gathering momentum. The minimum weekly wages for a trained machinist, which in July were 1,400 marks, have in August increased to 1,900 marks, and from the end of August to 3,000 marks or 70 times the pre-war average. This applies to conditions in Berlin. In some parts of Germany wages are somewhat lower and in others higher. It is interesting to note how little the wages for trained and untrained hands differ. The average wages for married trained men in Berlin in August were 1,962 marks per week, while an untrained man earned 1,830 marks or only 6½ per cent less. During September a further increase of wages of 30 per cent took place, and a rise of at least the same extent is already announced for October.

Position of Machinery Exports

In the German foreign business, which up to the end of July has accumulated a large balance on the wrong side, machinery exports form one of the most favorable features. In the case of machinery, the surplus from January to July was somewhat above 10,000 million marks. The figures shown in Table I taken from the official statistics, represent the returns of the foreign business of machinery during this period.

It can be seen that imports remained on the whole stationary, while exports show a steady increase up to June, followed by a considerable drop in July. Of imports, only a few classes run up to a larger amount, as, for instance, locomotives, weaving machines, harvesters and machine tools, which amounted to 1,103 pieces weighing 918 tons or nearly 15 per cent of the total. The imports appear even smaller when considering that a part of them comes from territories, like Danzig, politically detached from Germany, but economically still belonging to her. This applies for instance to the case of locomotives.

It is of interest to observe the prices per ton of machinery exported and imported. The fact that the average ton price is lower in the case of imported machinery is to be explained by the large percentage of imports from former German territories and countries with still weaker exchange, like for instance Austria. The average export price in January was approximately 28 times above pre-war level at a ratio of money depreciation of 1 to 45. By July the price had increased to 48,000 marks per ton, or 48 times the pre-war price. The corresponding ratio of the money exchange was during that month 1 to 110. Export prices have, therefore, not kept step with the drop of the mark. Compared to pre-war standards, exports remained only slightly behind those of 1913. The best return in comparison with that year is shown in the cases of locomotives, the export of which exceeds by far that of pre-war times, harvesting machines, blowers and ventilators, and machines for the leather industry. In a number of other cases it keeps approximately to the pre-war level, like cranes, sewing machines, machine tools, wood working machinery, printing presses, pumps, hoisting machinery. In all other cases, exports are more or less below pre-war level. The drop is especially marked in the case of textile machinery. The decrease in the grand total would be more strongly pronounced if deducting locomotives therefrom, the growing export of which is the balancing fact.

The figures shown in Table II represent the imports and exports of machine tools from January to July, 1922.

The imports show in the average a slight increase, but their total from January to July of 918 tons or 115 tons per month remains far behind that of 1913, when the monthly average was over 600 tons. In view of the difficulty standing in the way of such imports, not only of a financial nature, it is significant that they have already run up to 25 per cent of the pre-war level.

As to countries of origin, Holland sends the largest share, the United States, Switzerland and Austria following. The respective figures (January-July, 1922) are the following: Holland, 383 tons; United States, 139 tons; Switzerland, 115 tons; Austria, 81 tons; all other countries, 200 tons. The machine tools imported from Holland are, of course, not of Dutch make, but probably English or American, obtained through Dutch dealers.

TABLE II—GERMAN FOREIGN TRADE IN MACHINE TOOLS

For First Seven Months of 1922

	Imports			Exports			
	No. of Tools	Tonnage	Value Millions of Marks	No. of Tools	Tonnage	Value Millions of Marks	Prices per Ton
January	....	135,4	5,67	.....	6,897( )	173,9	25,000
February	....	62,5	3,6	.....	7,336( )	178,3	24,300
March	....	110	2,2	.....	6,852( )	184,8	27,000
April	124	164	3,9	9,837	4,486	185,5	41,000
May	118	69,7	2,5	8,067	3,496	173,5	49,600
June	361	253	4	9,560	3,918	210	53,000
July	103	124	6	9,376	2,983	181,8	61,000

Tool Prices Below Pre-War

Taking into account the number of tools imported, a tendency towards lighter types is exhibited. The same also applies to exports. In the Table II, the export returns of the first three months, marked (x), contain wood and stone working machinery, which, up to April have been listed with machine tools proper. Even so, it is clearly recognizable, that in the course of the year machine tool exports have dropped in weight if not in numbers. Below the ad valorem figures have been placed the average prices realized per ton, which allow interesting conclusions, when comparing them with the ratio of money depreciation and the sales prices directed by the Association of German Machine Tool Builders, in whose hands the export control rests. From January to March the price per ton hardly changed, although the mark dropped during that time from 200 to 280 to the dollar. An increase becomes noticeable from April to June, although the mark during this period remained almost stable, the further drop in July is not reflected in the ton price of this month.

A similar discrepancy is exhibited by comparison with the increases directed by the Machine Tool Builders' Association. On the average, the export prices realized are from 50 to 60 per cent of pre-war prices. Among the countries purchasing German tools, Belgium stands foremost, Italy, Spain, France, Holland, Austria and Checho-Slovakia following. Small Austria is still buying to nearly half of the extent of the former Austro-Hungarian Empire. Exports to Belgium, Italy and Spain exceed those of pre-war times. A good recovery is exhibited in the case of South American countries.

As a sign that an impending decline of business was anticipated in quarters capable of a general survey of conditions may be taken the increased attention to the problem of reparations in kind. The much discussed Stinnes contract is a first step in this direction, and the eagerness, exhibited in industrial circles, to follow this example or to join in the business, is significant. Similar contracts have been concluded by another large engineering combine and by a group of South German manufacturers of the metal working industry, including several machine building works. According to newspaper reports, a further number are in the course of preparation, amongst which may be mentioned a project initiated also under Stinnes' guidance for a combine between French iron ore producers and German steel works.

A certain danger is seen in the way the problem of reparations in kind is being put into effect, as it tends to further trustification on a large scale. It is expected that the German combines, which have taken the matter in hand, will make every effort to realize the best possible prices, i.e., the French market prices, which would seriously react upon German domestic prices, not to speak of the shortage, which would ensue from large quantities of goods extracted from the German market.

The keen interest given to the reparations problem is also significant for the disappointment felt after the expectations based upon the opening of the Russian market. From reports issued by the Soviet Government it appears that Germany has by no means captured the lion's share of Russian foreign trade and that the latter falls to Great Britain. The by far greater capacity of the latter country of financing such business is held responsible for this fact, and the growing difficulties of Germany in this respect have in the course of time greatly reduced even moderate expectations.

Employment Service for Engineers

The skilled technical man seeking employment as well as the executive in search of high grade help will find the employment bureau opened by the four national Engineering Societies, the offices of which are at No. 29 West 39th St., New York City, of great value. Members of many affiliated societies and organizations are available through this service bureau.

The service is free and parties interested are requested to communicate with W. V. Brown, manager, Employment Service, Engineering Societies' Building, No. 29 West 39th St., New York City.

Washington Notes

By Paul Wooton

In Europe today the greatest problem is that which has as its object the creation of a spirit for peace instead of a spirit for war. There are other problems of magnitude but in no case can their amelioration be purchased, either by the United States for giving the debts owed it by the European countries, or any other way. Their solutions lie in the moral, intellectual and spiritual fields. Incidentally it is the opinion of high officials in Washington that these problems should be solved singly. Effort to solve the problems jointly makes compromise inevitable.

That the United States ultimately will get back the capital sum involved in these loans to Europe, is the opinion held in a most authoritative official quarter. No one of the nations which entered into this obligation could continue to hold up its head and refuse to meet that debt. Its repayment is held to be a moral obligation to the American taxpayers.

Costly Militarism at Fault

No weight is given the argument that the United States should write off these obligations in an effort to compensate for its failure to enter the war in 1914. Those who have made a close study of the situation decline to admit that the United States was at fault for not having entered the war at that time. They hold that this country in taking up arms against Germany was actuated principally by a desire to prevent the collapse of civilization and to save Europe's drowning liberalism. In that connection it should be pointed out that the most reactionary American is more liberal than the most liberal European.

A reduction of the French army by 50 per cent would pay that nation's debt to the United States. In other countries as well it is held that there is nothing to justify military expenditures at the present rate. Were the United States to maintain military forces in the same proportion as is the case today in Europe, its standing army would be 1,000,000 strong. Even our economic system could not stand such a shock.

With Europe in a higher state of productivity than ever before, it would be little short of picking the pockets of the American taxpayers to cancel the debts, particularly in view of the ease with which the payments could be made were unnecessary drains on fiscal finance stopped. Moreover the United States has reached the point where its surplus of gold no longer is large. Month by month the balance of trade against us is diminishing. We may be exporting gold before six more months have rolled around. In 1921 a billion dollars of American money was loaned foreign industry. That rate is not being maintained this year, but even so the disproportion in the holdings of gold by the United States is about to disappear.

Sterling bids fair to be up to gold value in eighteen months. When that point is reached, it means that 85 per cent of the world's commerce will be on a gold basis. That will make for stabilization in some of the other currencies. There can be, of course, no hope for a return to normal in the exchange with countries which continue to publish money.

Mechanical Engineers Wanted

The United States Civil Service Commission in an announcement just issued, states that it will receive applications until December 5 to fill positions of inspector (mechanical) at the Naval Station, Pearl Harbor, T. H. The pay offered is $7.20 a day with an additional allowance of 96 cents a day while employed at the station. Transportation is furnished by the Government.

Competitors will not report for a written examination, but will be rated upon the subjects of technical education and preliminary experience (30 per cent) and special experience and fitness (70 per cent).

A degree in mechanical or electrical engineering from a recognized college or university and at least three years of certain specified experience are required, except that seven years of experience in mechanical engineering will be accepted in lieu of a college course.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the United States civil service board at the post office or custom house in any city.

German Secret Solved in New All-Metal Plane

A secret metal developed for German aircraft during the war has finally been successfully applied to what is said to be the first American-built, all-metal airplane to fly in this country. The metal, known as "duralumin" because it consists mostly of aluminum, has hitherto given trouble in the final processes of manufacturer upon which its strength and life depend.

Duralumin is used throughout in the "Batwing" airplane, the successful flying of which was announced last night by the inventor, Wm. B. Stout of Detroit, at a meeting of the Metropolitan Section, Society of Automotive Engineers.

As its name indicates, the batwing plane has a single wing shaped like that of a bat. But the spruce wood used in practically all aircraft to date has been replaced by structural members of duralumin, instead of cloth wing-coverings, the new machine has a duralumin skin, only a fiftieth part of an inch thick. Even the struts and cables used for bracing are now contained in the so-called thick-wing.

The eventual airplane, according to Mr. Stout, will be practically nothing but wings. Continuing he said:

"In a comparatively few years, wooden airplanes in the air will be scarcer than wooden ships on the sea. All airplanes flying under insurance rulings will be of all-metal construction.

"Metal planes mean greater safety to pilot and cargo; a possibility of considerably lighter weight; less production cost, particularly as the demand increases; and easier repairs.

"Thick-wing airplanes are developing fast, both in monoplane and biplane types. Retractable chassis, wing-type radiators, and other features that the recent Pulitzer races have shown to be practicable, will appear shortly in commercial airplanes and increase their profit-paying possibilities."

Business Items

The Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., has made the startling announcement of a reduction of $11 in the price of their Standard quarter-inch electric drill. They make it clear that this is the same machine which has been selling all this year at $39, although this machine is being constantly improved. The latest improvement is the supplanting of the hand chuck by a three-jaw geared-nut chuck. Production of these drills has trebled with the result that they are now able to sell them at $28.

The Herberts Machinery and Supply Co., 3rd and San Pedro Sts., Los Angeles, Cal., has been appointed exclusive representative by the Diamant Tool and Manufacturing Co., Inc., 91-97 Runyon St., Newark, N. J., in connection with the sale of Diamant standard punch and die sets, in the territory covered by the entire states of California, Arizona and Nevada.

The Natlay Chain Corporation, New York, has been incorporated by B. M. Bancroft and W. Hutchinson, with a capital of $100,000 to manufacture a patented steel chain as well as other mechanical equipment.

The Joyce Manufacturing Co., 2970 Jefferson Avenue, Detroit, Frank H. Joyce, president, recently incorporated with a capital of $500,000, has leased a factory building in that city and will manufacture automobile equipment.

The General Tire and Rubber Co., Akron, Ohio, will spend $100,000 on additional tire making machinery in connection with contemplated factory expansion.

The Firth-Sterling Steel Co. announces that it has added to its line of products the Globe polished drill rods drawn by the Globe Wire Co., Sharpsburg, Pa., and will carry stocks in its warehouses in New York, Boston and Philadelphia.

The Western Screw-Products Co., St. Louis, Mo., whose plant was destroyed recently by fire, has secured a new and permanent location at Main and St. George Streets, that city, and are engaged in equipping it with modern machinery. Production is expected to be started Nov. 15.

The Independent Pneumatic Tool Co., Chicago, announces that after Nov. 1, 1922, its Cleveland office will be located at 1204-5 Citizens' Building, Cleveland, Ohio, instead of 1103 Citizens' Building.

The C. F. Davis Machine Co., Rochester, N. Y., has moved its shop to 150 N. Water Street, occupying the second story of a new building, with greatly increased floor space and capacity.

The Coburn Machine Co., San Diego, Cal., has recently moved its plant from Second and G Sts. to 853 First Street, to secure larger quarters to accommodate its growing business.

The Whiting Corporation, Harvey, Ill., manufacturer of foundry equipment, announces that the C. F. Bulotti

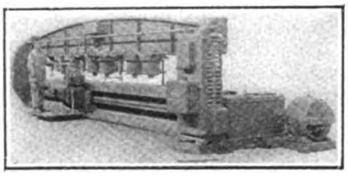
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Transformer, Welding and Heating, Electric
U. S. Electric Welder Co., 327 Permanent Bldg., Cleveland, Ohio
"American Machinist," September 21, 1922

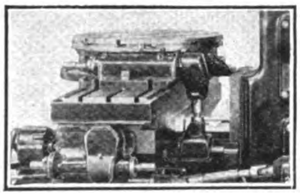
The transformer is for use where hard service is encountered and high power is necessary. It is made in a variety of styles and sizes for mounting in different types of equipment. The supports for the primary and secondary coils and for the core are so placed as to prevent humming and shifting of any of the parts. The secondary is built up of heavy rolled copper bands spaced to provide ventilating ducts and well supported and insulated. The cooling surface provided is large enough to keep the temperature within safe limits during heavy overloads. The internal reactance automatically prevents the current from building up so that the temperature rises more than 50 deg. C. above the room temperature.

Planer, Plate
Niles-Bement-Pond Co., 111 Broadway, New York, N. Y.
"American Machinist," September 28, 1922



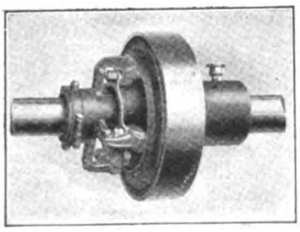
The principal features of the machine are the design of the bed and the method of attaching the carriage to the bed. Chips are thus prevented from getting on the bearing surfaces of the carriage and screw. The tool carriage is guided by square shears and is secured at both top and bottom by removable bearing supports which have taper gibs. The carriage is reversed automatically. The two swiveled relieving toolholder slides have simultaneous vertical adjustment and are mounted on a standard which has horizontal adjustment. Air is admitted into the tops of the pneumatic jacks for clamping the plate, and into the bottoms for unclamping. The direct-connected driving motor is controlled by a master switch, so that the machine may be started and stopped by a push button.

Table, Rotary, Milling Machine
Toledo Milling Machine Co., Toledo, Ohio
"American Machinist," September 28, 1922



The rotary table is controlled by the regular feed levers of the machine, including the traverse. It is driven from the feed drive shaft. The sixteen regular feeds of the machine are controlled by the same lever that controls the regular feeds of the table. More than one power feed cannot be engaged at a time. The quick return is also applicable to the rotary table in either direction. The table diameter is 24 in. but work of larger diameter can be accommodated. The table is graduated throughout the entire 360 deg., and divisions to minutes can be obtained.

Clutch, Friction, Heavy-Duty, "Universal Giant"
T. B. Wood's Sons Co., Chambersburg, Pa.
"American Machinist," September 28, 1922

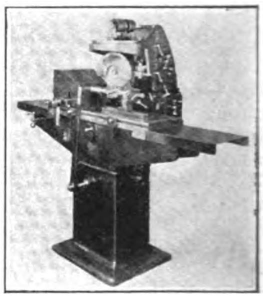


The disk clutch has recently been improved to adapt it to severe service encountered in the frequent starting and stopping of large machines or groups of machines. "Non-burn" friction lining is employed instead of the hard maple blocks. The clutch is made in sizes having rated capacities of from 5½ to 480 hp. at a speed of 100 r.p.m. It is of the floating disk type and may be furnished with one, two or three disks. It may be employed on lineshafts, directly on machines, or mounted in the bores of large pulleys and gears.

Lathes, Geared-Head, Heavy-Duty, 16- to 30-Inch
Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio
"American Machinist," September 21, 1922

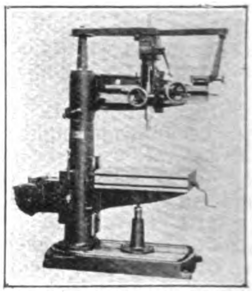
The lathes are driven by belt or by motor. The 16-in. lathe will transmit 9.2 hp. with a belt pull of 65 lb. per sq. in. The direct-connected motor-driven lathes can be provided with either chain drive or belt drive using an idler pulley. The motor can be mounted on the headstock or in the rear of the cabinet leg. The control may be by means of a rod above the lathe, by a handle at the front of the head or by a lever on the apron. A disk clutch fitted with a brake disconnects the spindle from all gearing when the machine is stopped. Twelve spindle speeds can be obtained with the three handles on the front of the head. On the 16-in. lathe the range of speeds is from 13.5 to 400 r.p.m. in geometric progression.

Grinding Machine, Hob and Form Cutter, Semi-Automatic, No. 10
Harris Engineering Co., Bridgeport, Conn.
"American Machinist," September 28, 1922



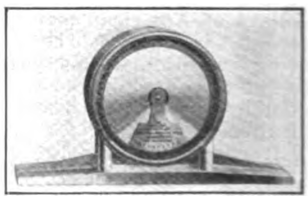
The machine is for use in shops where the number of hobs and cutters ground does not warrant the more expensive full-automatic model. The hob or cutter is carried on an arbor fitting into the work-carrying spindle. The work-holding table is operated by the hand lever at the front. Stops limit the stroke to the length of the hob. Hobs having helical flutes are rotated during the table travel by an adjustable sine bar. The spindle is driven by a belt at 2,700 r.p.m. By the truing device, teeth faces may be ground radial or with a top rake. Capacity, 8 in. in diameter and 10 in. long. Number of flutes indexed, 4 to 26. Floor space, 50 x 90 in. Weight, 1,760 pounds.

Drilling and Tapping Machine, Radial, Sensitive, High-Speed
Fosdick Machine Tool Co., Cincinnati, Ohio
"American Machinist," September 28, 1922



This drilling and tapping machine is for work that has too large an area for a high-speed sensitive upright drilling machine, and is also for small holes requiring a greater speed than can be attained on the heavy-duty model. The arm may be swung completely around the column. The sensitive feed and quick return are operated by the lever at the right or the handwheel at the left. For motor drive, a 1-hp. motor of constant or variable speed is required. The machines are built with either 3 or 3½ ft. arms. The dimensions are for the 3-ft. size. Table: vertical movement, 16 in.; working surface, 20 x 33 in.; maximum distance from spindle, 31 in. Spindles: No. 2 Morse taper; vertical traverse, 8 in.; horizontal movement, 28½ in. along the arm. Weight, 2,650 pounds.

Inclinometer, Universal
Stevens-Prentice Manufacturing Co., 377 National Ave., Milwaukee, Wis.
"American Machinist," September 28, 1922



The device is for reading and checking angles, bevels and levels. A vernier pendulum is pivoted in the center of the dial. A small brake stops the oscillation of the pendulum and holds it stationary while the reading is being taken. The device reads to 5 min., but can be furnished to read to minutes. When the line marked 0 on the vernier pendulum coincides with the line marked 0 or 90 on the scale of the dial, the instrument is plumb. The base can be fitted directly to the work that is to be measured and can be furnished with lengths of 7, 18 or 24 inches.

Clip, paste on 3 x 5-in. cards and file as desired

Machinery Co., 67 Main Street, San Francisco, Cal., has been appointed its agent for the State of California, to succeed Eccles & Smith Co., of the same city.

Personals

DR. A. C. HUMPHRIES, Stevens Institute of Technology, Hoboken, N. J., and president of the American Institute of Consulting Engineers, was the principal speaker at the fourth annual meeting of the University of Toronto Engineering Alumni Association held recently in the Canadian capital.

C. E. SKINNER, assistant director of engineering of the Westinghouse Electric & Manufacturing Company, has sailed to attend the meeting of the Rating Committee of the International Electro-Technical Commission to be held in Geneva, Switzerland, beginning November 18.

FREDERICK FRANZ, who for the past four years was chief engineer of the Terminal Engineering Co., has established an engineering office at 27 Warren St., New York City, for the purpose of solving special problems of engineering relating to labor saving machinery for industrial plants.

BENJAMIN G. LAMME, chief engineer of the Westinghouse Electric and Manufacturing Co., has been awarded the Joseph Sullivan medal by the Ohio State University in recognition of his notable engineering achievements.

Obituary

WILLIAM BLAKE WOOD, president of Gifford-Wood Co., of Hudson, New York, died October 28 at the Albany City Hospital, after a two weeks' illness. Mr. Wood was born in Arlington, Mass., July 15, 1869. He became a member of the firm of William T. Wood and Co., of Arlington, upon the death of his father in 1896 and continued as a partner with William E. Wood, and later as a member of Gifford-Wood Co. when incorporated in 1905, and succeeded Malcolm Gifford as president upon the latter's death in 1919.

O. B. FULLER, vice-president of the Enterprise Construction Co., died at his home in Los Angeles, Cal., Oct. 19, aged 57 years.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Hydraulic cotton presses for making bales weighing approximately 200 kilos and measuring 90 centimeters on each edge—Brazil. Purchase desired. Quotations, c.i.f. Brazilian port. Correspondence, Portuguese. Reference No. 4097.

Minting machinery, such as a coining press, a cutting-out machine, an edge-cutting machine, and a rolling mill, comprising in addition a breaking-down and finishing machine—Finland. Purchase desired. Quotations, c.i.f. Finnish port. Reference No. 4100.

Ice-cream-making machinery — Mexico. Purchase desired. Payment, cash. Reference No. 4101.

All machinery necessary for the establishment of a soap factory—Mexico. Purchase desired. Terms, cash against documents. Correspondence, Spanish. Reference No. 4102.

An oil-burning engine and attachments for use in a side-wheel flat-bottom scow ferry boat—Canada. Purchase desired. Quotations, f.o.b. port of shipment. Terms, cash. Reference No. 4103.

All material necessary for tin placer mining—Portugal. Purchase desired. Quotations, c.i.f. Lisbon. Terms, cash against documents. Correspondence, Portuguese or French. Reference No. 4105.

Machinery for sewing hemp soles to cloth shoes (alpargatas)—Argentina. Purchase desired. Quotations, c.i.f. Buenos Aires. Terms, cash against documents. Correspondence, Spanish. Reference No. 4106.

Representation of American firms desired, especially for the sale of goods requiring mechanical knowledge—Denmark. Reference No. 4107.

Aerial tramways for the transportation of lumber and mineral—Spain. Purchase desired. Quotations, f.o.b. New York. Reference No. 4110.

Machinery for the manufacture of pocketbooks, including sewing machines and gluing machines—Canada. Purchase desired. Reference No. 4111.

Milling machinery for small mills—Finland. Purchase desired. Quotations, c.i.f. Finnish port. Terms, cash against documents. Reference No. 4116.

Machine tools, leather belting, kerosene, spraying pumps and spraying materials and machines for orchards, plows, cultivators—Australia. Agency desired. Terms, cash against documents. Reference No. 4077.

Portable sawmill—Mexico. Agency and purchase desired. Quotations, f.o.b. factory or c.i.f. El Paso, Tex. Reference No. 4079.

Warehouse equipment, such as trolleys, hoists, packing machinery, stenciling machinery, and all such material as would be used in warehousing, motor-truck transportation, and the handling of cargo, also furniture covers—China. Purchase desired by firm in the United States having a branch agency in China. Catalogues, prices and full descriptive matter desired. Reference No. 4128.

A complete machine for grinding sugar cane, having 6 cylinders, and of a capacity for grinding 200 tons of sugar cane daily, also a steel or wooden elevator, or feeder, as well as a similar arrangement for carrying off the crushed stalks—Brazil. Purchase desired. Quotations, c.i.f. Brazilian port. Terms, cash against documents upon arrival of machinery. Correspondence, Portuguese, French or Italian. Reference No. 4140.

Machinery for the manufacture of shoe forms and heels—Italy. Purchase desired. Quotations, c.i.f. Genoa. Terms, cash against documents. Correspondence, French or Italian. Reference No. 4141.

Building hardware, trunk hardware, linoleum, etc.—Argentina. Agent is in the United States for the purpose of securing agency. Reference No. 4142.

Machinery for cannery, such as automatic press, sealing machines and automatic shears—Greece. Purchase desired. Quotations c.i.f. Greek port. Terms, payment against documents or irrevocable credit in New York. Correspondence, French. Reference No. 4143.

Steel pipes, of one-half to 6 inches—Syria. Purchase desired. Quotations, f.o.b. New York. Terms, 25 per cent cassh with order, balance against documents through bank in Tripoli. Reference No. 4144.

Wire-drawing and roller-mill machinery—Sweden. Purchase desired. Quotations c.i.f. Swedish port. Terms cash against documents. Reference No. 4145.

Machine-shop machinery, tools, and general supplies, such as lathes, planing machines, drilling machines and tools, steam hammers, foundry machinery, and cupolas for melting iron and brass—British Guiana. Purchase desired. Catalogues and prices requested. Reference No. 4147.

Machinery for the manufacture of pottery and porcelain, for drying and pulverizing clay, and for pulverizing hard rocks—Straits Settlements. Purchase desired. Quotations, c.i.f. Penang or Singapore. Catalogues are requested. Reference No. 4170.

Trade Catalogs

Logan Air Operated Chucks. The Logansport Machine Co., Logansport, Indiana. This company has just issued a new publication, known as Catalog R-15, which is a series of loose leaf bulletins, in bound form. It contains full descriptions and illustrations of the numerous types of Logan air operated chucks, labor saving devices and equipment for increasing production on automatics, turret lathes, and screw machines. Many drawings are given in the catalog showing the construction details of the different styles chucks, double acting air cylinders and other devices.

Die Heads and High Speed Tapping Devices. The Geometric Tool Co., New Haven, Conn. This company has just issued two new publications. One of them is a special booklet on the subject of its Style DS Geometric Screw cutting Die Heads, specially adapted for Browne & Sharp automatics and other single spindle machines. The publication contains a complete description of the mechanism with illustrations. The other publication is a booklet describing the company's Jarvis high speed tapping devices, tapping machines, quick change chucks and collets and self opening steel setters, with numerous illustrations.

Power Presses and Inclinable Open Back Presses. The Niagara Machine and Tool Works, Buffalo, New York. This company has just issued two new publications, on its line of presses. Bulletin 58, on its Inclinable Open Back presses is of 16 pages and describes in detail the constructive features of this line of equipment, its advantages and specifications with numerous illustrations accompanying the description. Bulletin 59 is a special four-page folder on the Niagara power press, containing a complete description with specifications and illustrations.

Pyrometers. The Brown Instrument Co., Philadelphia, Pa. "What's Under the Hood of Brown Pyrometers" is the title of a new bulletin just issued by this company. The publication has for its object a clearer understanding of the material and mechanism which goes into the company's product, how the product is designed and the method employed in putting it together.

Forthcoming Meetings

American Marine Association, Convention and Exhibition, Grand Central Palace, Nov. 3 to 11.

National Personnel Association, First Annual Convention, November 8, 9 and 10, at Pittsburgh, Pa. Secretary at 20 Vesey St., New York, N. Y.

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

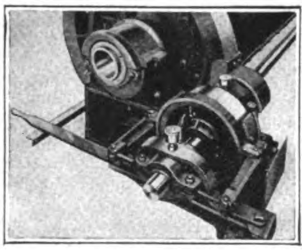
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Glue Pot, Bench, Electric
J. D. Wallace & Co., 1401 W. Jackson Blvd., Chicago, Ill.
"American Machinist," September 14, 1922

The temperature of this electrically heated glue pot is controlled automatically and the current may be taken from an electric lighting circuit. The temperature rises and is maintained between 140 and 150 deg. F. The glue is always kept at the proper temperature for use, although it is not cooked sufficiently to injure its holding properties. The pot may be employed either as a water bath, or as a hot air or a dry heat pot. The thermostat contains a sensitive volatile substance that contracts and expands with changes in temperature, so as to operate the control switch when the temperature rises to the upper limit or falls to the lower limit. The dial gage indicates the temperature.

Clutch and Brake, Combination, for Tumbling Barrels
Whiting Corporation, Harvey, Ill.
"American Machinist," September 14, 1922

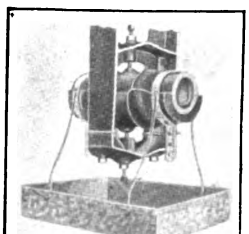


The mechanism is for use in starting and stopping tumbling barrels and mills. It is simple in construction and is controlled by a single hand lever. Shifting the lever toward the mill engages the clutch and starts the barrel rotating. To stop the barrel, the lever is moved in the reverse direction, passing through the neutral position and to the braking position. The clutch permits of stopping a loaded mill at exactly the point desired for unloading. The barrel is held in position while the unloading is taking place. Even though the barrel is unevenly loaded, it cannot turn when the brake is set.

Tiering Machine, Telescoping, Portable, "Economy"
Economy Engineering Co., 2635 West Van Buren St., Chicago, Ill.
"American Machinist," September 21, 1922

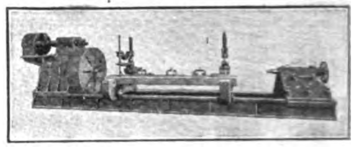
In this machine one frame member telescopes into another so that the machine has a lift nearly twice as high as its minimum height. It is made in both hand power and electric driven styles. The heavy-duty types of the latter style are operated from a power circuit, and the "Little Lifter" types from a lighting circuit. The machine is ordinarily mounted on three rollers, and when positioned for lifting the steering roller is raised so that the legs rest on the floor and prevent the machine from moving. Outriggers are provided for tall machines to support them at the sides.

Pan, Drip, Oil, Lineshaft
The Akron Sheet Metal Co., 103 No. Main St., Akron, Ohio
"American Machinist," September 21, 1922



The drip pan and hanger are for catching the oil that drops from bearing boxes. It is especially intended for use on overhead lineshafts, but can be adapted to bearings secured to wall or post brackets. The pans and hangers are made in three sizes, each size being suitable for a range of shaft sizes. Shafts from $\frac{13}{16}$ to $2\frac{15}{16}$ in. in diameter can be fitted. The hangers can be quickly installed on any style of bearing box. The pan may be easily removed for cleaning without disturbing the hangers. Sizes, 6 x 8 in., 8 x 10 in., 10 x 12 in.; 2 in. deep.

Lathe, Roll, 42-Inch
Reading Iron Co., Scott Foundry Dept., Reading, Pa.
"American Machinist," September 14, 1922



The machine has a capacity for turning a chilled roll 42 in. in diameter by 120 in. long. It is driven by a 20-hp. variable-speed motor, the speeds of which range from 400 to 600 r.p.m. The gear box has two changes of speed, arranged so that the full range of motor speed can be employed with each. The face-plate speed varies from 0.4 to 1.6 r.p.m. The main spindle is $7\frac{7}{8}$ in. in diameter, and the gears are machine cut. The bearings are large. The heavy construction provides the strength required for heavy service. Weight, 35,000 pounds.

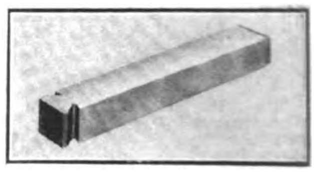
Grinding Machine, Pulley
Diamond Machine Co., Providence, R. I.
"American Machinist," September 21, 1922

The machine is for grinding the faces and edges of pulleys and similar parts. It carries a 14-in. diameter cylinder wheel held in a steel chuck that insures against wheel breakage. The wheel spindle, running on ball bearings, is driven by a 10-hp. motor at about 1,500 r.p.m., the speed being varied to suit the work. The work table has screw-operated movement in three planes, and an auxiliary rapid movement to and from the wheel actuated by a hand lever. Pulleys may be ground with crown, flat, or concave faces. Capacity: pulleys of 2 to 18-in. diameter, up to 6-in. face. Floor space, 3 ft. 6 in. by 4 ft. 6 in. Weight, 2,000 pounds.

Wrench, End, Adjustable, "Instant-Positive"
Gellman Wrench Corp., 131 W. Washington St., Chicago, Ill.
"American Machinist," September 21, 1922

The end wrench can be adjusted instantly and stays adjusted until the nut is loosened or tightened. It is strong, but light in weight and thin enough to work in cramped places. No screw is employed in the wrench. The handle member forms the lower jaw and is notched at right angles to the gripping face, while the movable upper jaw is also notched and can be moved up or down when the notches are pulled out of engagement. The wrench can be turned in either direction. The tool is manufactured in sizes of 6-, 9- and 12-in. The 6-in. wrench is suited for light work. The 9- and 12-in. are for heavy duty but fit small nuts as well as large ones. Weight, 4, 10 and 20 ounces.

Key, Machine, Self-Fitting, "Keytite"
Smith & Serrell, Central Ave., at Halsey St., Newark, N. J.
"American Machinist," September 21, 1922



The key is capable of making its own fit in the keyway by shaving the sides of the keyway as it is put in place. It is ground to a size very slightly larger than the nominal width. A cutting edge and chip recess are provided near the front end of the key and a pilot, slightly smaller than the nominal keyway width, fits the keyway and guides the key. In the larger sizes, cutting edges are sometimes provided on both sides. For fitting the top and the bottom as well as the sides, a cutting edge can be provided at the top. Gib keys and other modifications of keys can be furnished with the self-fitting feature. The keys can be furnished in a wide range of sizes, as to both width and length.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Calif., Vallejo—The city, T. D. Kilkenny, City Engr.—$1,000 worth of machinery for proposed garage and repair shop on Virginia St.

Ill., Anna — A. Hargrave (machinist) — short engine lathe, 20 to 28 in. swing.

Ia., Fairfield—Louden Mchy. Co.—One No. 32 Kempsmith milling machine (used).

Kan., Wichita—E. L. Bryan, 622 Pattie Ave., (garage)—drill press, belting, hangers, emery wheel and stand for power equipment (used).

Kan., Wichita — O. G. Smith Machine Shop, 132 North Lawrence Ave.—milling machine and drill press for power equipment (used).

Kan., Wichita—Universal Repairing Co., 122 East 2nd St., (cabinet worker)—A. Travis, Purch. Agt.—wood lathe for power attachment (used).

Kan., Wichita — W. J. Williams, 1103 Lulu Ave., (machinist) — power lathe (used).

Mass., Cambridge—D. E. Forsyth, 14 Parker St.—machinery and equipment for proposed garage at 17 Coventry St.

Mass., Winthrop—Winthrop Motor Sales Co., Somerset Ave.—machinery and equipment for proposed garage.

Mich., Muskegon Heights—The Maxim Motor Co., C. Branston, Purch. Agt.—lathes, drill press, also screw and milling machinery for proposed factory.

Mo., Kansas City—Flexibuilt Belt Mfg. Co., 4404 East 15th St.—pipe threading and cutting machine.

Mo., St. Louis — Mid-Continent Equipment & Mchy. Co., Security Bldg., C. G. Davis, Purch. Agt.—stamping press.

N. Y., Buffalo—J. Waechler, Ross and Ontario Sts.—machinery, tools and equipment for garage and service station.

N. Y., Long Island City—A. Kimoney, 276 Jackson Ave. (builder)—small electric portable riveter.

N. Y., New York—J. E. Kahn, 224 West 20th St. (plumbing)—sheet metal working tools, including brake, etc.

O., Columbus—Brightman Bros. Co., 531 Linwood Ave., (manufacturer of shafting, etc.), G. F. Brightman, Purch. Agt.—screw making machinery, lathes, grinders, presses, etc.

O., Columbus—Fairfield Eng. Co., West 6th St., along tracks of Hocking Valley Ry.—lathes, drill press, grinder, etc.

Ore., Portland—The city, L. D. Kaiser, City Hall, Supt. of Water Works—$1,350 worth of hand tools and one tapping machine.

Pa., Phila.—Pennsylvania R.R., 17th and Filbert St., M. Smith, Purch. Agt.—one 90 in. tire mill, one 6 and one 4 spindle bolt turning machines, 3 turret lathes, ten 4 x 36 in. emery grinders, two 15 in. and three 18 in. slotters, three No. 5 knee type milling machines, 17 engine lathes, six 36 and three 48 in. vertical turret lathes, two 36 in. planers and two 90 in. drive wheel lathes, for shops at Altoona.

Pa., Phila — Sobel Machine Co., 880 North 48th St., (machinists), A. Sobel, Purch. Agt.—16 in. shaper (used preferred).

Pa., Sharon—R. Deflin—Complete equipment for proposed welding and machine shop on River Ave.

W. Va., Wheeling—Hazel Atlas Glass Co. —machine shop equipment for branch plant at Washington, Pa.

Wis., Green Bay—J. Strathas, 315 Cass St. (garage)—repair machinery, small tools and air compressor.

Wis., LaCrosse — Bergh Auto Co., 207 South 4th St.—auto repair machinery, including drill press and small tools.

Wis., Madison—West End Auto Repair Co., c/o J. B. Sanborn, 16 North Carroll St.—repair machinery and chain hoist.

Wis., Milwaukee—Wisconsin Sheet Metal & Furnace Wks., 2928 Lisbon Ave., A. Blecker, Purch. Agt.—punch press to punch ½ in. hole, with cutting attachment, also one large size beader.

Wis., Milwaukee — Wisconsin Steel & Dock Co., 253 3rd St., (structural steel and marine repairs), F. W. Stevens, Purch. Agt.—punch presses, power shears, pneumatic tools and air compressor.

Que., Levis—Levis County Ry., E. E. Weyman, Mgr.—32 in. lathe, screw jack car hoist, shaper, vertical drill, double end emery grinder, combination circular saw, planer and band saw and small lathe.

Machinery Wanted

Ark., Conway—Conway Weekly News—linotype and other printing equipment.

Calif., San Diego—Kirk, Roche & Co., 338 7th St.—sheet metal work machinery, also catalogues and prices of machinery for the manufacture of restaurant equipment, furnaces, heating and ventilating equipment, skylights and cornices.

D. C., Wash.—U. S. Chief Engineer—one locomotive crane.

Fla., Daytona Beach—Peninsular Ice & Cold Storage Co., G. G. Bailey, Pres.—cold storage and ice manufacturing machinery and equipment for proposed $100,000 plant here.

Ill., Chicago—Kraft Bros. Cheese Co., 402 Rush St.—special cheese making machinery, belting and shafting, for branch at Antigo, Wis.

Ill., Chicago—W. S. Swift, Brevoort Hotel, 120 West Madison St. (machinist)—emery stand and wheel, sand blast, jig saw for power attachment.

Ind., Hammond—Wanner Malleable Iron Wks.—power hammer.

Ind., Lafayette — The National Refining Co., Kossuth St.—machinery and equipment for proposed oil refinery to replace that which was recently destroyed by fire.

Kan., Wichita—Bd. Educ., C. P. Mueller, Pres., 145 North Main St.—tenon power saw for manual training department of public school.

Kan., Wichita—J. Robertson, 1435 Pattie Ave.—complete set boiler maker's tools and welding outfit for welding boilers.

Ky., Bargourville—Cumberland & Manchester R.R. Co., C. F. Heldrick, Purch. Agt.—equipment for proposed forge shop.

Ky., Montago—Means-Haskins Coal Co.—coal tipple machinery and equipment, including handling and conveying equipment.

La., La Fayette—The La Fayette Sugar Refining Co.—machinery and equipment for proposed refinery, to replace that which was recently destroyed by fire.

Mich., Detroit—J. C. Green, 3656 Seminole Ave.—band saw, wood turning lathe, rip saw, buzz planer and thickness planer.

Minn., Minneapolis — Century Laundry Mchy. Corp., 426 Lincoln St., N. E., J. T. Marrin, Purch. Agt.—machinery and equipment for the manufacture of laundry machinery.

Mo., Carthage—Carthage Casket Co., c/o E. Ulmer Undertaking Co.—wood working machinery.

Mo., St. Louis—C. L. Holland, 909 North 15th St.—power job printing press and power paper cutter.

Mo., St. Louis—Modern Printing Co., 2604 Olive St.—12 x 18 in. Chandler & Price press (used preferred).

N. Y., Buffalo—DuPont Fibre Silk Co., River Rd.—machinery and equipment to double present capacity of plant.

N. Y., Buffalo—C. Grant, 75 Eagle St.—printing machinery for plant at 77 East Eagle St.

N. Y., Buffalo—C. Sudrow, 633 Bway.—machinery for the manufacture of wooden bodies for cars and trucks, for plant at 1099 Genesee St.

N. Y., Buffalo—U. S. Radiator Wks., 1285 Main St., W. H. Smith, Purch. Agt.—equipment for repairing automobile radiators, fenders and bodies, for plant at 16-18 Glenwood Ave.

N. Y., Chili (Lincoln Park, P. O.)—J. Harris Seed Co. (seed distributors and sorters)—machinery and equipment for proposed addition to seed plant.

N. Y., Fairport—Douglas Packing Co.—complete machinery and equipment for proposed addition to packing plant.

N. Y., Fredonia — Grape Ola Products Corp., (manufacturer of grape products), H. Card, 123 Cushing St., Dir.—machinery and equipment for proposed addition to plant.

N. Y., Jamestown—Jamestown Panel Co., 34 Steele St.—machinery and equipment for two story addition to panel and furniture factory.

N. Y., New York—Bd. Educ., Park Ave. and 59th St.—P. Jones, Supt. of School Supplies—receiving bids until Nov. 10th for work shop supplies for the day and evening, high and elementary schools.

N. Y., New York—New York Central R.R., Purchasing Dept., 466 Lexington Ave.—one 90,000 lb. power press brake, motor driven.

N. Y., Olean—Olean Garment Mfg. Co., 430 North Union St., E. I. Lovitz, Mgr.—machinery and equipment for garment factory.

N. Y., Rochester — Rochester Packing Co., 900 Maple St.—machinery and equipment for cold storage plant, and for the manufacture of sausage.

N. Y., Tonawanda—The National Roofing Co., Fillmore St.—complete machinery and equipment for proposed branch factory at Athens, Ga.

O., Akron—Enterprise Mfg. Co., 217 Ash St. (manufacturer of small brass, nickel and steel parts)—sand blasting equipment.

O., Cleveland—The Upco Co., 4805 Lexington Ave.—steam jacketed kettles, about 50 gal. capacity.

O., Cleveland—The Wilkshire-Wilk Co., 2162 East 2nd St.—annealing gas furnace with blower (used).

O., Columbus—Dept. of Finance of Ohio, State House, R. V. Johnson, Supt. Division Purchase—one 40 x 94 in. reverse drying tumbler, one No. 38, one No. 51 and two 42 x 84 in. Universal presses, one 48 in. over driven type extractor and other laundry equipment, for the Institution for Feeble Minded.

O., Columbus—Western Newspaper Union —job printing press and paper cutter for power equipment.

O., Lima—Buckeye Casting Co.—equipment for new $75,000 foundry.

O., Ottawa—Putnam Mfg. Co., (manufacturer of wooden articles), G. W. Kahle, Mgr.—complete woodworking equipment for factory.

O., Springfield — Robbins-Meyers Co., Shuey Bldg. (manufacturer of electric motors, fans, etc.)—machinery and equipment for proposed additions to factory.

O., Urbana—Gaumer Publishing Co., (job printers)—No. 5 linotype machine (used).

O., Warren—The Wadsworth Feed Co., J. X. Wadsworth, Pres.—$20,000 worth of machinery for proposed flour mill to replace that which was destroyed by fire.

Pa., Bridgeville—Universal Steel Co.—one 10 ton crane.

Pa., Corry—The Corry-Jamestown Furniture Co.—machinery and equipment for proposed addition to furniture factory.

Pa., Darby—Darby Print Shop, 232 Mall St.—one 10 x 15 in. press, type stands, type, etc.

Pa., Edwardsville (Kingston P. O.) — Wyoming Valley Bakery, R. H. Levy, 388 Chestnut St., Kingston, Dir.—equipment for new bakery.

Pa., Erie — The Dispatch-Herald, 12th and French Sts.—linotype machines and other printing equipment.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Lead quoted in New York warehouses at 7⅜c. as against 6.95c., a rise of $10 per ton in two days; zinc, now 7⅝c. as compared with 7½c. per lb., one week ago. Tin also advanced 1c., making the present warehouse price 38c. per lb. Zinc sheets up ¼c. per lb. in casks. Both white and red lead, dry and in oil, advanced ½c. per lb. f.o.b. New York.

Declines—Steel plates quoted at maximum of $2 per 100 lb., f.o.b. Pittsburgh, on sizeable tonnages. Shapes quoted as low as $1.90 on attractive business and at a maximum of $2.10 where orders involve special considerations and speed in shipments, consistent with present embargoes, but average remains at $2 per 100 lb., f.o.b. mill. Market soft on bars with few new inquiries. Some orders booked at $1.90 but average price $2. Sales, however, of carload lots for early delivery quoted at $2.10 per 100 lb.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	33.27
Southern Ohio No. 2	33.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	35.80
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	32.64
Virginia No. 2	37.17
Basic	31.75
Grey Forge	30.50
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	31.77
Basic	31.77
Bessemer	33.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5
Cleveland	2.4

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.85	4.19	3.70	4.00
No. 12	2.60@2.95	4.24	3.75	4.05
No. 14	2.70@3.00	4.29	3.80	4.10
No. 16	2.90@3.30	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.60	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.65	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.70	4.80	4.30	4.75
No. 28	3.35@3.75	4.90	4.40	4.85
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11.	3.35@3.85	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.95	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.25	5.30	4.80	....
Nos. 22 and 24.	3.90@4.40	5.45	4.95	5.40
No. 26	4.05@4.55	5.60	5.10	5.55
No. 28	4.35@4.85	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.82½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
⅛	6.50		11@12
$\frac{5}{32}$ to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.50
Tin, 5-ton lots, New York	38.00
Lead (up to carlots), St. Louis	6.80; New York. 7.37½
Zinc (up to carlots), St. Louis	7.10@7.15; New York. 7.62½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	18.75	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.00	10.25	.....
Solder (½ and ½), (caselots)	26.50	23.50	20.00
Babbitt metal (83% tin)	35.00	45.00	36.00
Babbitt metal (35% tin)	25.00	17.25	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.75	12.00
Copper, heavy, and wire	11.75	12.25	11.50
Copper, light, and bottoms	9.75	10.25	10.50
Lead, heavy	4.75	5.25	4.75
Lead, tea	4.25	4.25	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.75	6.00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3 00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per b.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.94
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville... per net ton		$8.00	
Coke, prompt foundry, Connellsville... per net ton		10.50@12.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ¾ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
⅜ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.55	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0 35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	40-5%	40½%	50%
Heavy grade	30-5%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2 67	3.20

Pa., Huntingdon—Extension Radiator Wks.—foundry equipment to replace that which was recently destroyed by fire.

Pa., Lebanon—R. Boyer—machinery for the manufacture of special automobile hing-rim.

Pa., Phila.—Majestic Silk Dyeing Co., 3rd and Bristol Sts.—winders, dyeing vats, accessories and drying frames.

Pa., Pittsburgh—Guibert Steel Co., 703 Diamond Bk. Bldg.—joiners, woodworking machinery, compressors and band saws.

Pa., Pittsburgh — Pennsylvania R.R., Union Sta., W. G. Phelps, Purch. Agt.—two cranes for Conway shops at Freedom.

Pa., Sheffield—Sheffield Glass Bottle Co. —machinery and equipment for large addition to glass bottle works.

Pa., Tamaqua — Tamaqua Mfg. Wks. (manufacturer of mining machinery)—machinery and equipment for proposed addition to plant.

Pa., Warren—Bd. Educ., c/o J. G. Smith, member Bldg. Com.—vocational equipment for proposed $400,000 junior high school.

F I., Woonsocket—The Manchester Co., (manufacturer of cotton and woolen goods) —looms and other machinery for mill at North Oxford, Mass.

S. D., Edgemont—The Printer, Box 567— complete newspaper equipment, including press, job press, linotype, hangers, pulleys, belting and bearings.

Tenn., Dyersburg — Churchill Compress Co. — complete machinery and equipment for proposed cotton compress plant.

Tenn., Morristown — Taylor Mfg. Co., (woodworking plant), W. H. Taylor, Pres. —band saw, jointer, planer, line shaft, pulleys and several electric motors.

Tex., Athens—Citizens Ice Co., F. N. Drake, Dir.—machinery and equipment for ice manufacturing plant, to replace that which was destroyed by fire.

Wis., Beloit—F. R. Fiebke & Co., 751 5th St. (general contractors)—woodworking machinery for new shop.

Wis., Beloit—Perrigo Fdry. and Machine Co., 8 Emerson St., W. S. Perrigo, Purch. Agt.—foundry equipment.

Wis., Boscobel—National Wood Products Co., c/o J. M. Reppen—woodworking machinery.

Wis., Cedar Grove—Cedar Grove Shoe Mfg. Co., M. J. De Master, Purch. Agt.— shoe working machinery.

Wis., Fort Atkinson—Better Sox Knitting Co., 211 South Water St., D. Becker, Mgr. —power and special machinery for proposed factory.

Wis., Green Bay—A. F. Coffrin, South State St. (paper manufacturer)—belt driven conveying machinery.

Wis., Madison—W. D. Bird, Pioneer Bldg. (jobber)—complete newspaper plant, including printing press, linotype, belting, hangers, pulleys and motor shafting (used).

Wis., Milton—Burdick Cabinet Co., F. A. Anderson, Purch. Agt.—nickel plating machinery and equipment.

Wis., Milwaukee—C. Daniel, 1741 Teutonia Ave. (carpentry and millwork)—cut-off saw.

Wis., Milwaukee—A. G. Faehnel, 748 New York Ave. (carpentry and mill work) — joiner and rip saw.

Wis., Milwaukee—Kath Monument Co., c/o J. G. Jansen, 1223 38th St., (monuments)—stone cutting machinery.

Wis., Milwaukee—S. Kosecki, 1479 Fratney St. (carpentry and millwork)—one electrically operated floor surfacing machine.

Wis., Milwaukee—R. E. Oberst, Archt., 307 Grand Ave. (owner's name withheld)— gasoline storage tank and pump for proposed $40,000 garage on 16th St. and Fond du Lac Ave.

Wis., Milwaukee—A. Sandrock Co., 1217 4th St. (structural steel), W. A. Sandrock, Purch. Agt.—power saw.

Wis., South Milwaukee—A. E. Koerner (newspaper and job work)—paper cutter, printing press, belting, shafting, linotype, pulleys, hangers for power equipment (used).

Wis., South Milwaukee—South Milwaukee Brick Co., 706 Hawthorne Ave., E. C. Guhr, Purch. Agt.—motor driven mixing machine and crusher.

Wis., Walworth—Walworth Condensed Milk Co., refrigeration machinery for proposed addition to condensery.

B. C., Nordin—The J. Buckley Estate— machinery for proposed sawmill to replace that which was destroyed by fire.

B. C., Vancouver—Standard Shingle Co., Ltd.—machinery and equipment for proposed shingle mill.

N. B., Bathurst — Bathurst Co. — additional equipment for sulphate pulp mill to increase capacity from 15,000 to 19,500 ton.

Metal Working Shops

Calif., Emeryville—The Great Western Meter Co., 5701 South San Pablo Ave., Piedmont, has had plans prepared for the construction of a 1 and 2 story factory, here. Estimated cost $30,000. G. Rushforth, 354 Pine St., San Francisco, Archt.

Calif., Fresno—The Lisenby Mfg. Co., Kern and Angus St., awarded the contract for the construction of a factory for the manufacture of multicolor presses. Estimated cost $10,000.

Calif., Sacramento—The Latourette-Fical Co., 907 Front St., plumbing and heating contractors, will soon award the contract for the construction of a 3 story workshop. Cost between $17,000 and $19,000.

Calif., San Francisco—J. Cassaretto, 347 Berry St., has had plans prepared for the construction of a 1 story, 90 x 125 ft. machine shop on N.W. Folsom and Dore Sts. Estimated cost $25,000. M. Sheldon, 110 Sutter St., Archt.

Calif., San Francisco—E. L. Reese, 332 Pine St., awarded the contract for the construction of a 1 story factory on Bryant St. near Morris St. Estimated cost $6,000. Gorman Metal Co., 141 Clara St., manufacturer of babbitt steel, lessee.

Calif., Vallejo—The city has had plans prepared for the construction of a 50 x 130 ft. garage and repair shop on Virginia St. Estimated cost $4,000. T. D. Kilkenny, City Engr.

Calif., Watsonville—Watsonville Union High School Dist. will soon award the contract for the construction of a 1 story machine shop. T. S. MacQuiddy, Clk. Noted Oct. 12.

Ia., Dubuque—Bosky's Motor Co., 6th and Iowa Sts., is having plans prepared for the construction of a 3 story, 100 x 110 ft. garage. Estimated cost $60,000. Private plans.

Md., Baltimore—The American Can Co., 120 Bway., New York City, plans to build a factory on Boston and Hudson Sts., here. Estimated cost $350,000.

Mass., Chicopee—The Moore Drop Forging Co., 38 Walter St., Springfield, awarded the contract for converting office building into laboratory, and for the construction of a 1 story, 40 x 90 ft. machine shop, on Depot St., here. Estimated cost $25,000. A. L. Converse, Purch. Agt.

Mass., Pittsfield—The General Electric Co., River Rd., Schenectady, awarded the contract for the construction of a 1 story, 100 x 516 ft. factory, here. Estimated cost $150,000.

Mass., Roxbury (Boston P. O.)—The J. J. Walsh Co., 1540 Columbus Ave., awarded the contract for the construction of a 2 story, 50 x 100 ft. factory for the manufacture of automobile bodies. Estimated cost $30,000. Noted Oct. 19.

Mich., Kalamazoo—The Kalamazoo Blow Pipe Co., 408 Church St., is having plans prepared for the construction of a 1 story, 35 x 155 ft. factory. Estimated cost $50,-000. E. Batterson, Archt.

Mich., Muskegon Heights—The Maxim Motor Co. awarded the contract for the construction of a 1 story, 62 x 240 ft. factory. Estimated cost $30,000.

N. Y., Brooklyn—B. A. Davies, c/o B. Driesler, Jr., Engr. and Archt., 153 Remsen St., will build a 1 story, 100 x 200 ft. garage on Empire Blvd. Estimated cost $115,000.

N. Y., New York—The Dept. of Water Supply, Gas and Electricity, Municipal Bldg., awarded the contract for the construction of a garage on East 24th St. Estimated cost $23,700. Noted Oct. 5.

N. Y., New York—M. Low, c/o L. Sheinart, Engr. and Archt., 194 Bowery, will soon receive bids for the construction of a 3 story, 100 x 125 ft. garage on Amsterdam Ave. and 57th St.

O., Cleveland—The Brough Co., 3823 St. Clair Ave., manufacturer of beverages, is having plans prepared for the construction of a 1 story, 30 x 80 ft. and 50 x 80 ft. garage and bottling works on East 72nd St. and St. Clair Ave. Estimated cost $40,-000. E. Brough, Mgr. J. Brugnone, 3505 Woodlawn Ave., Archt.

O., Cleveland—The Glauber Brass Mfg. Co., 7706 Platt Ave., plans to alter and build a 1 and 2 story addition to its factory. Estimated cost $50,000. M. Glauber, Pres. Private plans.

O., Cleveland—The Hydraulic Press Steel Co., Hydraulic Ave., awarded the contract for the construction of two 1 story, 30 x 30 ft., 33 x 40 ft. factories, and a 20 x 50 ft. crane runway. Estimated cost $50,000.

O., Cleveland — The Mall Motor Co., 4900 Euclid Ave., awarded the contract for the construction of a 1 story, 50 x 150 ft. garage. Estimated cost $40,000. A. Hass, Mgr.

O., Cleveland—J. Sands, East 55th St. and Sweeney Ave., manufacturer of water heaters, awarded the contract for the construction of a 1 story, 60 x 100 ft. machine shop at 10205 Harvard Ave. Estimated cost $40,000.

O., Kent—The Falls Rivet Co. awarded the contract for the construction of a 1 story, 168 x 210 ft. addition to its factory. Estimated cost $50,000.

Pa., Pittsburgh—The Guibert Steel Co., Diamond Bk. Bldg., is having plans prepared for the construction of a 1 story, 55 x 200 ft. steel fabricating plant on West Park St. Estimated cost $100,000. Private plans.

Pa., Sharon—R. Deflin plans to build a 1 to 2 story, 30 x 50 ft. welding and machine shop on River Ave. Estimated cost $6,000.

Tex., Waco—The Texas Fireproof Storage Co. awarded the contract for the construction of a 4 story, 50 x 100 ft. warehouse and garage on 11th and Mary Sts. Estimated cost $100,000.

Wis., Milwaukee—The O. Jaeger Baking Co., 914 Central Ave., awarded the contract for the construction of a 1 story, 50 x 150 ft. garage on 9th St. Estimated cost $40,-000. Noted Oct. 26.

Wis., Wausau—The Wausau Wrecking Co. awarded the contract for the construction of a 4 story, 60 x 120 ft. garage. Estimated cost $40,000.

General Manufacturing

Mich., Muskegon—The Central Paper Co. is receiving bids for the construction of a 3 story factory, consisting of six buildings, on Lake St. Estimated cost $200,000. Private plans.

N. Y., Rochester—W. B. Williams, 295 Monroe Ave., plans to build an addition to paint shop. Estimated cost $6,500. Architect not announced.

Pa., Pittsburgh—The McCallum Co., 137 7th St., florists, receiving bids for the construction of a 3 story, 40 x 120 ft. factory at 1803 Beam Ave. Estimated cost $20,-000. Private plans.

Tenn., Chattanooga—The Dixie Spinning Mills is building a 1 and 2 story, 67 x 387 ft. mill, and a 40 x 156 ft. boiler, machine shop and pump building. Estimated cost $500,000. Noted July 13.

Tex., Dallas—The Stickle Lumber Corp., Maple Ave. Rd., will build a 1 story, 100 x 200 ft. and 60 x 60 ft. flooring mill and power plant. Estimated cost $75,000.

Vt., Brattleboro—The Twin State Gas & Electric Co., Barber Bldg., is receiving bids for the construction of an addition to gas plant, including scrubbers, holders, etc. Estimated cost $40,000. Private plans.

Va., Gore—The Winchester Lumber Co., Winchester, plans to build a lumber mill, here. Estimated cost $35,000. W. B. Cornwell, Pres. Architect not announced.

Wis., Antigo—The Pacific Ice Cream Co. awarded the contract for the construction of a 2 story, 50 x 64 ft. ice cream factory. Estimated cost $50,000. H. Quackenbush, Mgr. Noted Sept. 21.

Wis., Fort Atkinson — The Better Sox Knitting Co., 211 South Water St., is receiving bids for the construction of a 2 story, 50 x 66 ft. factory. Estimated cost $40,000. D. Becker, Mgr. Private plans.

Wis., Kaukauna—The Ground Wood Pulp Supply Co. will build a 2 story, 60 x 80 ft. pulp mill. Estimated cost $50,000.

Wis., Loretta (Draper P. O.)—The Hines Lumber Co., Park Falls, will build a 1 story, 75 x 100 ft. saw mill, here. Estimated cost $75,000.

Wis., Milwaukee—The Natl. Knitting Co., 905 Clinton St., awarded the contract for the construction of a 1 story, 40 x 100 ft. addition to its factory. Estimated cost $25,000.

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Automatic Arc Welding

Applications of the Process at the General Electric Company's Schenectady Plant—Manufacturing Solenoid Brake Wheels—Seam Welding—Repairing Armature Shafts

By A. K. WEST

A LITTLE OVER a year ago the automatic arc welder was brought to a state of practical application. It is now used in the manufacture of a number of products in some of the General Electric Company's plants as well as for various kinds of repair and reclamation work. The manufacturing processes are on the quantity basis and the variety of products is sufficiently large to give an idea of the extent of the field to which the automatic welder may be applied.

This welder is a device for automatically feeding a bare electrode to a welding arc at the rate required to hold a constant arc length. The welding head consists of a steel body carrying feed and straightening rolls which pull the wire from the reel, straighten it, and feed it to the work. The rolls are adjustable for sizes of electrode wire from $\frac{1}{16}$ to $\frac{5}{32}$ inches in diameter. In applying the automatic welder it is necessary to provide some means of moving the arc relative to the work, or vice versa. The majority of arc welding work comes under two general heads, straight line and circular welds, spiral welds being a combination of the two. For such cases, various types of existing machines have been used successfully as a base for the application of the electric welder. Such machines are lathes, for obtaining line welds and spiral welds, and boring mills or turn tables for circular welds. In some cases, however, the welding path is complicated or irregular. It is for these that special machines have been designed in order to obtain the proper travel, either of the work or of the welding head. Also, some of the articles welded are too heavy and bulky to be mounted on ordinary machines and have required the designing of special machines to handle them.

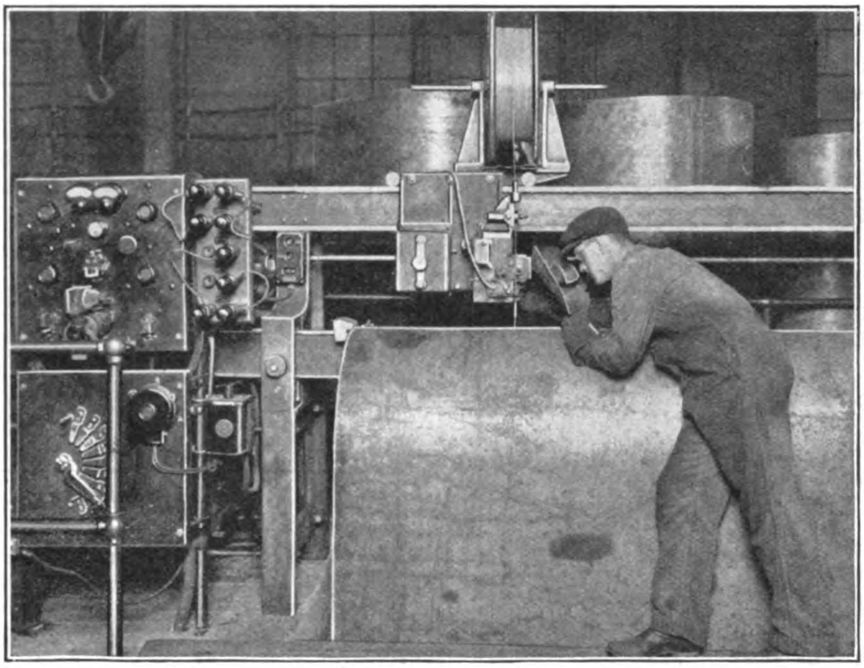

FIG. 1—AUTOMATIC WELDER CLOSING SIDE SEAMS ON LARGE TANKS

One of these built for the welding of side seams in large oil circuit breaker tanks is shown in Fig. 1. The tank is clamped in position on an I-beam with a copper strip on the upper flange, the strip serving as a backing for the weld. The welding head and the wire reel are mounted on a traveling carriage above this beam. The carriage is driven by a long screw shaft between the upper supporting beams, by a motor at one end of the machine.

The welding head is driven through a splined shaft by a motor at the other end. The two driving motors are so interlocked that when the arc is struck the travel motor starts, simultaneously, and if the arc is broken for any reason the travel motor stops. Dynamic braking of the travel motor prevents drifting and insures the starting of the weld at the point where it left off. The rate of welding on this machine, which handles seams up to 108 in. in length, is about 2½ in. per minute, varying, however, with the thickness of the material to be welded. Another type of machine has been designed for welding on the bottoms of smaller tanks. It appears in Fig. 2. The welding path in this case is so much more complicated that a different mechanism is required. The outline of the path is two semi-circular ends, joined by tangential sides. In this case the arc is held stationary and the work moved past the point of contact by a rack which engages with a small pinion driven by the travel motor through the gear train.

An interesting case which has resulted from the application of the automatic welder to production work is the fabrication of brake wheels for solenoid brakes. Formerly these wheels were cast, but so much trouble was experienced from blow holes that showed up when the wheels were machined, rendering them a total loss, that a new welding process was devised to make them. The machine is shown in Fig. 3. The wheels are fabricated from three parts, the hub, cut from a piece

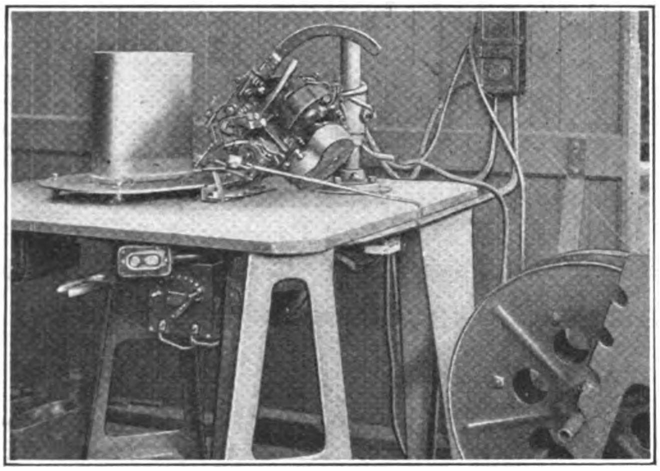

FIG. 2—AUTOMATIC WELDER ATTACHING TANK BOTTOMS

of steel shafting, the web and the rim, which are both cut from boiler plate, the latter being rolled into shape, and the ends joined by welding. (Fig. 2.) The three are then mounted together on a turn table and welded together to form the finished wheel shown in Fig. 4. Not only does this process save the money that was formerly lost in scrapped wheels, but it obviates making

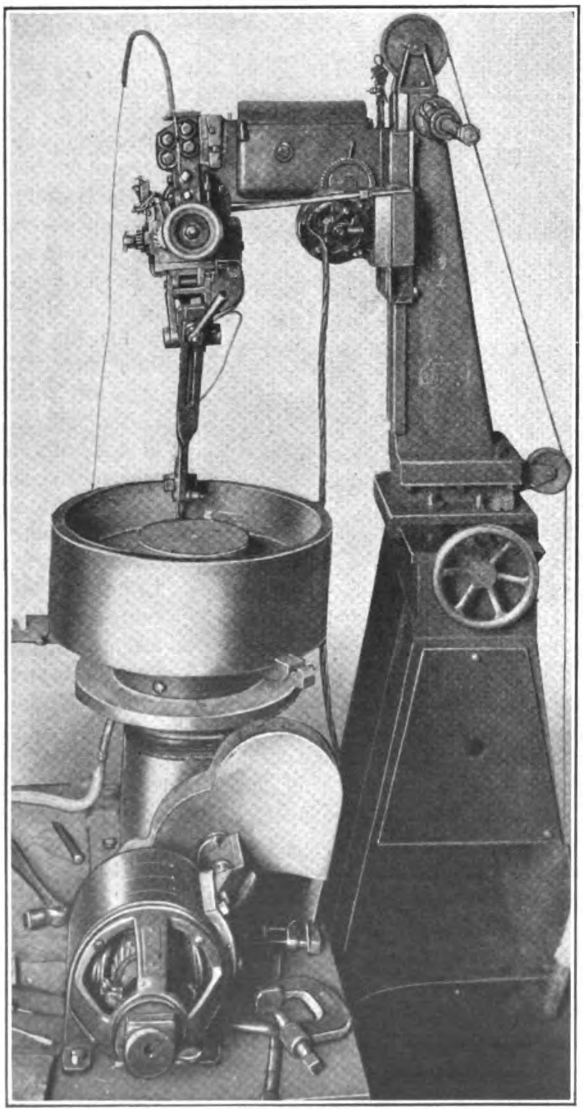

FIG. 3—WELDING TOGETHER SOLENOID BRAKE WHEEL PARTS

a special pattern and mold for every special type of wheel wanted, requiring tapered shafts, offset rims, etc.

These three processes are by no means the only ones that have been improved by the application of automatic welding. The method is now applied to the manufacture of a number of products that were formerly cast or riveted, with the usual expenditures and rejects that attach themselves to those methods. A few of these articles are railway motor gear cases motor frames, motor bearing shells, flow meter nozzles, and condenser cans. Both butt and lap welding are employed and the thickness of the metals welded varies from $\frac{1}{64}$ inch for the condenser cans to $\frac{5}{8}$ inch for the motor frames and some of the other larger articles.

The automatic process has also been very successfully applied to various kinds of reclamation and repair work, with considerable saving of money and material as a result. One such case is that of several large and expensive shaft forgings that were improperly machined, or required increases in diameter after being machined.

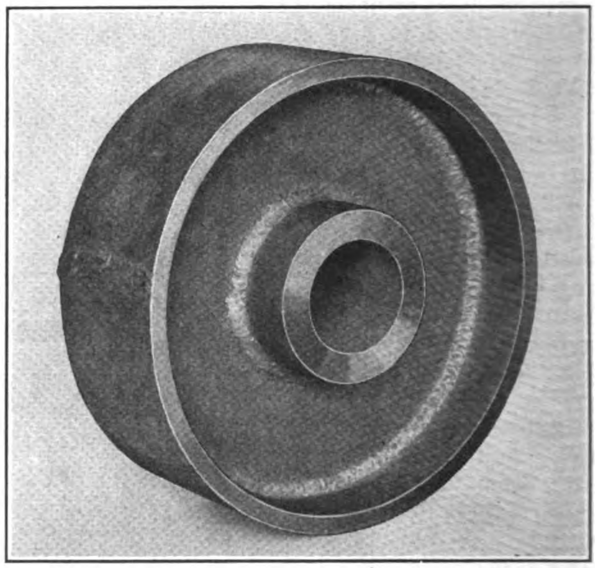

FIG. 4—THE COMPLETED SOLENOID BRAKE WHEEL

The shafts, which in some instances would have been a total loss, have been reclaimed in a very few hours and at a nominal expense.

Another case is that of armature shafts that have had their journal, pulley, or gear fits worn so as to render them unfit for further use. Over 400 of them have been reclaimed by welding with the automatic equipment, the metal being deposited on the shaft to any desired thickness and then machined to proper dimensions. In many cases the insertion of a shaft would necessitate the complete disassembling of the armatures, as in many of the smaller sizes the laminations are assembled directly on the shaft.

The result of the application of the welder to both manufacture and repair have been highly satisfactory. The automatic machine deposits metal much faster than is possible with hand welding, and the resultant weld is better both for smoothness and evenness of the deposited metal. The main consideration in designing machines for carrying either the work or the welding head, or in adapting existing machines to these purposes, is to insure a steady and uniform rate of travel of the arc along its path, and proper interlocking between the arc and the travel mechanism, so that simultaneous starting and stopping will be assured.

What's Wrong with the Railroad Shops?—II

The Show Machine and Its Use and Abuse—Desire of the Men to Make a Showing When Possible—General Condition of Equipment

The condition of railroad shop equipment is a very sore subject. The machinist resents the fact that he has to work with poor tools, the mechanical department official is at his wit's end to get out work with the equipment at hand, the purchasing department is hampered by financial control that restricts the appropriations available for machinery and makes the purchase of cheaper substitutes almost unavoidable. The average board of directors, facing earnings of three per cent, more or less, is hard to convince that a department which is looked upon as an expense, should receive much of the meager income. It seems impossible to prove to regulatory bureaus that their policy is starving the railroads to death.

Our second article shows railroad shop equipment as it is and suggests more efficient use of what is available, as well as the need for replacing the obsolete units with modern ones.

ONE GETS THE impression when talking with the average railroad shop man that the railroad shop is an institution by itself, only remotely related to the machine shop and other industries, somewhat like the relation of the horse and the frog; they are both vertebrates but that is about all. Those responsible for the running of the ordinary machine shop realize the importance of keeping in close touch with all that goes on, not only in their own industry, but in other industries as well. They are constantly on the lookout for new methods, and, whenever they read or hear about some new development in some other line of industry, they weigh the possibility of applying this improvement to their own conditions.

It is true, not all do this and it is also true that a certain amount of inertia and conservatism on the part of the workers, and often, of foremen and superintendents must be overcome, but, stated briefly, it is true that the manager of the machine shop keeps his eyes open for better things and better methods. He must. Competition compels him to. Even without competition there would still be the constant urging of the directors for reduced costs and for increased profits—a good stimulant.

He studies the technical magazines devoted to machine shop methods, new machinery and tools; he visits other plants to get new ideas, and, on the whole imparts as much information as he gets. He sends his superintendents and foremen out on occasional trips and even if these men do not return with revolutionary ideas in regard to shop operations, they come home refreshed and encouraged and full of enthusiasm. Sometimes they return humbled and chastened by what they have seen others do, but in any case they come back better men.

The manager sees the salesmen of the machine and tool manufacturers and the makers of other equipment and considers these men not as so many book agents, nuisances to be gotten rid of as quickly as possible, but as the carriers of valuable information. If he finds that the purchase of new equipment will lead to new economy he tells the purchasing agent what to buy. He has joined various associations and urges his subordinates to join them for the purpose of keeping abreast of the times, of listening to discussions or taking part in them and of obtaining much information which is enthusiastically discussed at such meetings and of which much can be used at home.

He encourages suggestions from his assistants and, though he may not always follow them, he considers them carefully. If his time is too much taken up with other duties and he cannot devote the proper attention to technical matters, or, if his training or ability is not along these lines, he calls in an expert from the outside to assist him and his staff, always with the idea that a sufficient broadness of view, a sufficient amount of knowledge cannot be gathered in one plant. In short, he considers his plant as but a single unit in a great system, deriving support from and giving assistance to other units.

If the average shop profits by information obtained from manufacturers of equipment, it is also active in promoting progress in the design of new machinery and tools. The shop makes certain demands for new features, often to the extent of having special machinery built. Such machinery, when proven successful, may become the standard of the future. This insistence on improved features, designs or materials is the very foundation of progress made in machinery and other machinery. Its influence reaches far indeed.

The railroad shop is largely lacking in this broadening interchange and adoption of ideas. How often does one see the master mechanic of a railroad shop ambling through a plant where automobiles or sewing machines or heavy ordnance pieces are being made? For that matter, how often does he visit other railroad shops? If he does there must be something in the management of railroads which prevents him from using the knowledge thus obtained, for a greater lack of uniformity in methods than one finds in railroad shops is hard to imagine, though such shops are more alike in the nature of their operations than almost any other class of industrial establishments.

It must be said here that, in our opinion, the men themselves are not to blame. A number of them confessed they were somewhat ashamed of their ignorance as to what was going on in the outside industrial world, and defended themselves on the ground that they had no chance for observation. Where lies the exact center of the idea that the railroad shop is "quite apart" is not easy to determine. It has existed so long that it has permeated everything. The dilution of the old force with a number of new men recruited after the strike from other shops, from the farms and other outside occupations may kill the old idea. Let us hope so.

The example of the connecting rod mentioned in a

previous article shows how little uniformity there is between different railroad shops. It also shows how an ineffective machine was used and how even this was reduced to about one-third of its capacity by poor tools. Such examples can be found in large numbers. They were standing out all over every shop we visited. As against this, we were shown the pride of the shop, the driving wheel lathe (this did not happen in just one shop, but in practically all).

Though of various makes these machines were all more or less up to date. The driving wheel lathe was the show machine. Fortunately we have seen heavy chips before and are not easily impressed with them unless they are the symbol of rapid production. This is what we noticed:

One driving wheel lathe was heavily overloaded during the roughing cut. The tool rests bent down under the cut like grain before the wind. A cut was taken $\frac{1}{2}$ in. deep and $\frac{3}{8}$ in. feed, speed about 16 ft. The machine had the requisite power but not the rigidity for such a cut. The gib for the tool slide was merely a flat piece of cast iron held in place by a number of set screws (a very poor construction). These screws had been set up so tight that they had made their impression on the gib. It bulged at the other side and made a cup shaped depression in the slide so that sidewise movement of the slide was no longer possible until the gib was loosened. Now let us see what was the benefit derived from this brutal performance.

Analysis of Tire Turning Operation

The accompanying sketch, Fig. 1, shows the outline of a tire before and after turning. It also shows the scallops or grooves made by the roughing tool. These grooves may seem exaggerated and so they are but, due to the bending of the tool rests, there were many spots in every groove quite as deep as the impressions shown here. After roughing, a forming cut is taken and the illustration shows clearly how the depth of these impressions makes a very deep forming cut necessary.

It should be noticed that the depth of this cut is several times the depth of the impressions. Now this forming cut calls for hand feed and is, therefore, necessarily a slow operation, so that everything possible should be done to reduce the depth of that cut. If less

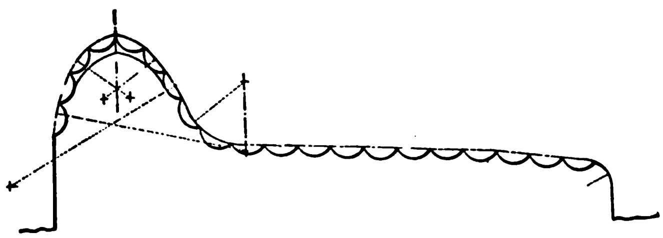

FIG. 1—DIAGRAM SHOWING EFFECT OF FORCING CUTS IN A WHEEL LATHE

feed had been used for the roughing cut with somewhat higher speed, the impressions would have been very much shallower and the depth of the forming cut would have been very much reduced. Possibly five minutes extra might have been spent on the roughing but this would have been saved several times over on the forming.

While talking about this forming, it is a peculiar fact that on the driving wheel lathe a forming tool without rake is used. In a way the railroad shop men are not to blame for this because the lathe does not allow of any other kind of tool. Fig. 2A shows how the tool is now and Fig. 2B how it might be made if the lathe had provision for it. Such a forming tool would cut freer and do faster and better work.

It is perhaps pertinent to state here that such forming tools as shown in Fig. 2B cannot be used on automatic screw machines, for instance, without making provision for vertical adjustment but this is so because on such types of machines the work is of small diameter. The very large diameter of work on a driving wheel lathe would make the loss of height due to sharpening the tool on the face an utterly unappreciable quantity.

We said that the railroad shop men are not entirely to blame, but after all it is up to them to analyze their problems and demand the necessary features in the machine tools they buy to give them the best results.

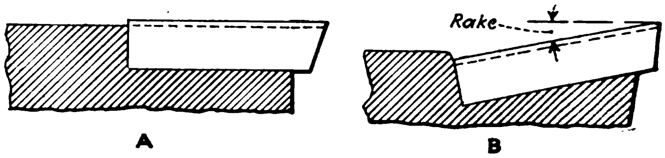

FIG. 2—TOOLS WITH AND WITHOUT RAKE

On the other hand would their demands be heeded by the purchasing agent or by whoever has the final decision, and if not can we blame them if they recognize the futility of analyzing problems when they are not in a position to profit by the analysis?

At another place the driving wheel lathe was of more rugged design and quite capable of taking the cuts imposed on it but here again too much was left for the slow forming operation. In addition, the handling devices were entirely inadequate so that half an hour or so was lost on this account while every effort was made to save a minute on the roughing cut.

Every effort? Well, in a manner of speaking, but the cut had to be interrupted because the tool gave out. Investigation showed too much clearance, with its result, a weakened tool. Besides, so the workman claimed, the steel was soft. What kind of steel? Nobody within hailing distance knew. Maybe the purchasing agent knew but he was not around. How was this defect going to be corrected? Send it back to the blacksmith shop and a tool dresser would try again.

There was probably somebody in authority in the shop who knew what kind of steel it was and what to do to improve its cutting capacity, but the fact that neither workman, foreman nor assistant superintendent knew these things is significant. It does not make for intelligent co-operation.

Men Anxious to Make a Showing

We could not help but look at the driving wheel lathe performance from different angles. The eagerness to show the heavy cuts proved that the men had the desire to break some records and grasped one of the few opportunities they had to do so. They seemed to realize that the greatest part of their equipment would not allow them to make a showing. There were just the driving and car wheel lathes and the tire boring machines which would give them that chance. With the evident desire to do themselves proud it would seem that the main thing required for an up to date shop, the willingness to make it so, was there. What was lacking was evidently training in modern shop methods, equipment and a certain amount of freedom of action which is so necessary for development.

Another angle which presented itself is this, why was

there an up to date driving wheel lathe when the rest of the equipment was mostly below par? Why was this so in most shops? The answer seems to be that the driving wheel lathe, the car wheel lathe and the tire boring machines are machines specially built for the railroad shops. The makers compete with each other and bid against each other with improvements. A driving wheel lathe must be a driving wheel lathe; it would not be possible to substitute any other kind of a lathe for it and so the buyer is compelled to get the up to date thing if he buys at all. This is true of all equipment built for railroad shops only.

A different condition exists in relation to other equipment. A lathe is a lathe in the eyes of such a disinterested spectator as a purchasing agent may be. Nobody is making any particular effort to make milling or drilling machines especially adapted to the railroad shop because there are not the special requirements to be met as was the case with the driving wheel lathe, the car wheel lathe, the tire boring mill or the double and connecting rod boring machines. Unless, therefore, the men most interested, the men who are supposed to know, specify the kind they want they will get what seems to the purchasing agent the most advantageous purchase. Unfortunately in many cases the shop does not have the privilege of specifying and in others where they do specify, the purchasing agent has the privilege of ignoring the demand of the shop.

Though the modern tire boring machine is also one of the show machines in the better equipped railroad shop it will be found that there is such an astonishing lack of uniformity in the practice of tire boring that it is extremely difficult to find any explanation for it except the one that each shop follows its own ideas without any regard whatsoever for the experience of others. We refer the reader to an article appearing in the *American Machinist* of Aug. 21, 1922, entitled "Angles of Cutting Tools," by J. Herron, in which the author shows that feeds and speeds, angles of tools and everything else in relation to this operation vary within the widest imaginable limits, showing that nobody has profited by the experience of anybody else.

It would seem to us that this utter lack of systematic co-operation, or let us call it intercourse between the various railroad shops, and especially study of practice of shops in other industries, is responsible for much that may be criticised in the railroad shops of today. A thing entirely apart from the men, their ability, their relations with each other or with the outside world is the average condition of the machinery. A railroad shop must be a healthy place for a machine tool judging by the number of old and venerable tools found there. With very few exceptions, there are a number of tools in each railroad shop that had probably reached a comfortable middle age when wood burning locomotives were all the style.

The claim that railroads are poverty stricken does not explain the existence of so many relics for most of them must have been old when the roads were prosperous and mighty. The only reasonable explanation seems to be that the railroad shop is the step child of the company, on which money is spent only when there is no way out of it.

To enumerate the many old and dilipidated machines noticed, would be to give a dreary list containing many names of fossils, known to science only. The condition must be seen to be appreciated. It is our opinion that the railroads could not spend money to a better or more profitable purpose than by cleaning out the old junk and replacing it with the proper kind of modern machinery.

These Figures Show No Standardization of Catalog Sizes

During a period extending over several months, the *American Machinist* recorded the sizes of the catalogs it received. The total of catalogs was 190, the total of sizes 62. Herewith is the tabulation:

Size			Quantity	Size			Quantity
1⅜	by	5¾	1	6	by	9	33
3¼	"	6	1	6¼	"	9¼	2
3¼	"	6¼	1	6½	"	9½	1
3½	"	5¾	1	7	"	10	2
3½	"	6	7	7	"	11	1
3½	"	6¼	3	7¼	"	7½	1
3½	"	6½	1	7¼	"	10	1
3½	"	8¼	1	7½	"	9	1
3¾	"	8	1	7½	"	10½	2
3¾	"	8¼	1	7¾	"	10½	1
4	"	6	1	8	"	9	1
4	"	7	1	8	"	10	3
4	"	7¼	1	8	"	10½	9
4	"	8½	1	8	"	11	3
4	"	9	8	8¼	"	10¼	2
4¼	"	5½	1	8¼	"	10½	1
4¼	"	6¾	1	8½	"	10½	1
4⅜	"	9½	1	8½	"	11	57
4¾	"	7¼	2	8½	"	11½	1
4¾	"	7¾	1	8¾	"	11	1
5	"	7	3	8¾	"	11¼	2
5	"	7½	2	8¾	"	11½	2
5	"	8	3	8¾	"	11¾	1
5¼	"	7¼	1	8¾	"	12	1
5¼	"	7½	1	9	"	10½	1
5¼	"	8	1	9	"	12	4
5¼	"	8¼	2	9¼	"	43	1
5¼	"	9½	1	11	"	14½	1
5½	"	8	1	15½	"	22	1
				17	"	22	1

The majority, it is pleasing to note, were 8½x11 in., a size that is logical on account of its present acceptance as the standard letter sheet. For the catalog that will be used in the office and salesroom and carried in brief cases, that size is probably the best. The pocket size, say 4x6 or 5x7, as a second size, has much in its favor.

As the first step, a standardized size should be determined. After that, refinements, such as punching for a standard binder, should be considered.

Two Hundred Miles per Hour Necessary for Commercial Aviation

Commercial aviation can hardly be accomplished until a speed of 200 miles per hour can be maintained. This opinion has been expressed in connection with the study of results at the Detroit meet. At slower speeds aircraft can rarely be expected to compete with other forms of transportation.

When the distance between Chicago and New York can be covered in two or three hours or San Francisco can be reached in 15 hours of continuous flying from New York, there would be a demand for the service, despite its cost. Only three days of daylight are lost to the passenger who crosses the continent by rail. By the impracticability of night flying no great amount of time is saved to the passenger who undertakes the journey by air under existing conditions. The possibilities of commercial aviation are unlimited and now depend on speed development.

Inclusions in Aluminum-Alloy Sand Castings

By R. J. Anderson

Technical Paper No. 290, of the Bureau of Mines, Department of the Interior, is the result of the suggestion made by a number of foundrymen that the bureau investigate hard spots, put the available information on record and suggest preventative methods. Hard spots, due to foreign matter other than iron, originate in the foundry and can be prevented by not allowing such materials to get into the melting furnace.

When the melting room and foundry floor are being cleaned to gather up small pieces of metal, sloppings and overruns, dirt, gravel, sand, cement, brick and chunks of broken crucibles are swept up. Unless these sweepings are sieved and forked, such materials are likely to be charged into the melting furnace. Whether under fast practice or a moderate rate of production, it will pay to watch the quality of the melting charge. Some of the foreign material may be removed by skimming and fluxing, but if this material is readily wetted by aluminum and is of nearly the same density, it will remain in the liquid metal and will ultimately appear in the castings.

Crucibles should not be used too long or until they become cracked and readily friable. No core sand should be left in defective castings that are remelted, as the hard, fine, silica particles may give rise to small hard spots. Foreign non-metallic hard spots can be largely eliminated, provided sufficient attention is given to the charging practice.

Limiting the Iron Content

In regard to the hard spots caused directly or indirectly by iron, the iron content of No. 12 alloy or of other alloys made from secondary ingots can be kept within reasonable limits by using only such ingots as are reasonably low in iron. Difficulties brought about by the use of secondary ingots or scrap castings purchased from outside sources, can be readily eliminated by chemical analytical control. Actual irony hard spots caused by charging nails, core wire, chills and bits of iron and steel can be prevented by careful attention to the quality of the charge.

Mechanically admixed iron appearing in the foundry scrap or in floor sweepings can be removed by screening and forking, or by electromagnetic apparatus if required. If small loose scrap is charged by fork rather than by shovel, small particles of iron or non-metallic particles should readily fall between the tines of a fork, whereas they would be retained by the shovel and go into the charge. However, if too much scrap is picked up on the fork, the small pieces will not fall through and forking does no good. Unless small forksful of scrap are taken and the scrap shaken up and down on the fork, forking is useless. In certain foundries, forks are used like shovels, but if they are not used correctly they may as well not be used at all.

The practice of charging borings and turnings has practically been abandoned and these materials are usually run down into ingots before charging. In a machine shop, however, iron and steel drillings and turnings may become admixed with aluminum-alloy borings. Unless it is known that aluminum-alloy borings are free from mechanically admixed iron, they should not ordinarily be charged directly. At best it is not good practice to use borings in melting charges because of heavy dross losses.

Hard spots, due to the brittle, complex, ferro-aluminum alloy which forms on the sides of iron pots, may be largely prevented by thoroughly scraping the pots at frequent intervals and by removing the accumulated scale. If eight or nine hour practice obtains, the pots should be scraped at least once a day, say at night, and preferably twice a day, at noon and at night. If two shifts are working, more frequent scrapings will be advisable.

All of the hard alloy should be removed so that the pot is clean and, if necessary, the pot should be dumped. Moreover, during the time the pot is in the melting operation, care should be taken that ladles or stirrers do not hit the sides of the pot. Otherwise, some of the accumulated scale may be knocked off. In the same way, the scale may be dislodged at charging time. By careful attention to the foregoing precautions, the occurrence of hard spots in aluminum-alloy castings that give rise to difficulty in machining and polishing can be largely eliminated.

A complete copy of the paper may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the price of ten cents.

Machine Shop Bulls—IV

By Joe V. Romig

Ed was working on a long center shaft, 3 15/16 in. in diameter and 14 ft. long. This shaft was a red rush job; the mill in which it was used was shut down, men were idle and had to be sent home, and an express car stood waiting to ship it the moment it was finished.

The shop super and foreman had strict orders to rush it through and had given it to their best lathe hand because they could trust him. Every pad had been turned accurately to size and all that still remained was to taper bore the lower end for the thrust bearing spud. Working fast, Ed took a chance without "miking" his bore soon enough, and bulled the job, the roughed hole being 1/8 in. oversize.

To admit the bull meant the scrapping of the shaft, costly delay to the shut-down plant of the customer and possibly dismissal. A quick conference with his pal decided the course of action. Ed was to bore out the over-size hole to exactly 2 in. in diameter, and Joe, his buddy, immediately turned up a 2-in. plug to fit. This plug exchanged hands quickly and secretly and was socked into the finished bore, a light tapping fit.

The dog was still in position on the plug, and this dog was used when the lathe was started up in low gear to make out the cut-fast fit, the only possible way which they had to tighten the plug without causing suspicion. The plug, fitting neatly, allowed the shaft to make a few revolutions, when it smashed its supporting block into splinters and cut fast like a good fellow.

A few minutes of high-speed turning and drilling made a new hole, dead to size and taper, and the shaft went out of the lathe to the inspector's bench without a soul being the wiser. All had been done so quickly and quietly, that no one knew of the bull but its maker and his buddy. As far as the strength and mechanical fitness of the job was concerned, everything was above board; and by taking this bull by the horns, Ed saved himself an embarrassing situation.

Bulls will creep in once in a while for everyone, and although they are the most unwelcome of creatures in a shop, they must be handled with philosophy and reason.

Multiple Fixtures for Milling Small Parts

A Description of Fixtures Used in Milling Service Machine Parts—Design Applicable to Fixtures for Parts of Other Machines

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In DESIGNING multiple fixtures, a considerable amount of thought should be given so as to get the largest amount of production with the least amount of expenditure for tools. The fixtures should be made substantial to withstand the cut and still be simple as possible, both for loading and replacing worn parts.

The accompanying photographs show fixtures used on milling operations for small parts on sewing machines, which increased production from 200 to 400 per cent, with a very small amount of tool cost. These fixtures have been in use for over two years proving very satisfactory and, with slight changes, could be used on other classes of work.

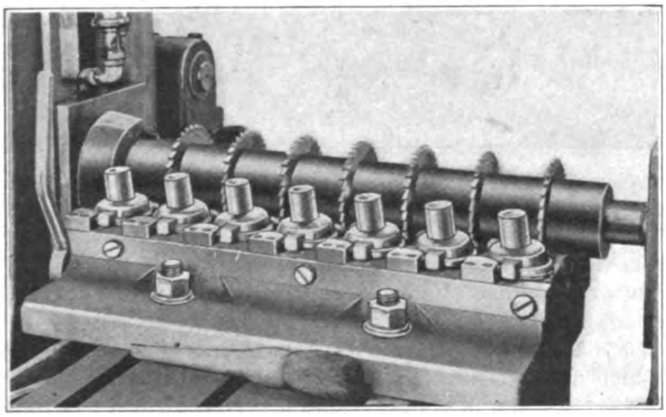


FIG. 1—SET-UP FOR SLOTTING SHUTTLE RACES

In Fig. 1 there is shown a fixture set up in position for use on a Lincoln type milling machine. This fixture holds seven sewing machine parts, known as shuttle races, in each of which a slot ⅛ in. wide by ⅞ in deep is milled by feeding the parts into the cutters to a stop. The arbor of the machine is 1¼ in. in diameter and holds seven ⅛ in. by 4½ in. standard saws, separated by spacers of equal length. The center of the arbor is set slightly above the center of the slot which is to be milled. By revolving the cutters downward toward the work, the arbor is forced down upon the fixture and no clamping is necessary.

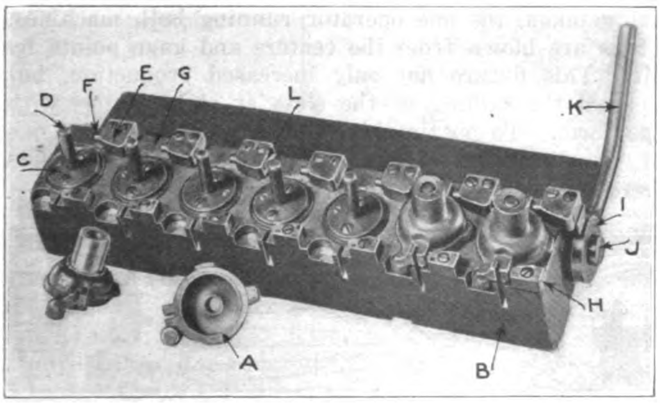


FIG. 2—THE SHUTTLE RACE FIXTURE

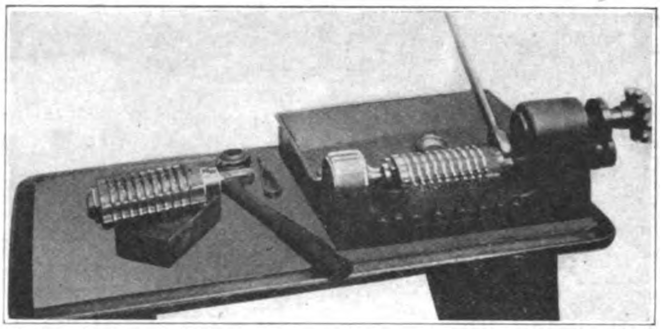


FIG. 3—LOADING THE SHUTTLE RACE COVER ARBOR

The details and method of operation of this fixture are given in Fig. 2. The work is shown at *A*. The body of the fixture, *B*, is made of cast iron and machined to receive the smaller parts. It will be noted that it has been machined at seven regular intervals along one side in the form of semi-circular slots in order to provide clearance for the button of the shuttle race *A*.

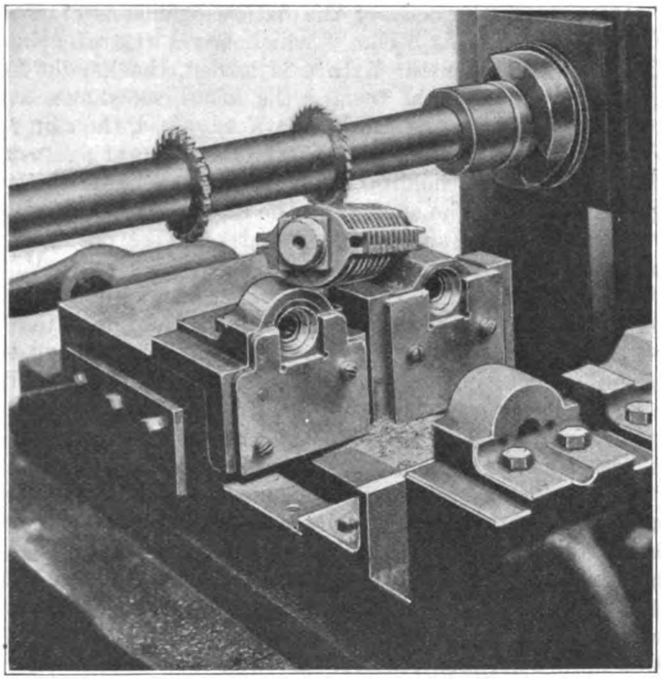
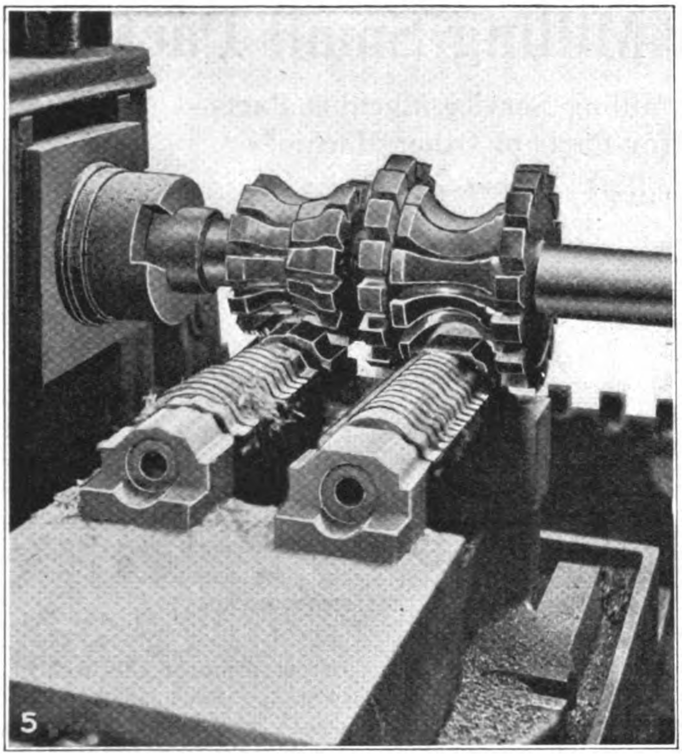
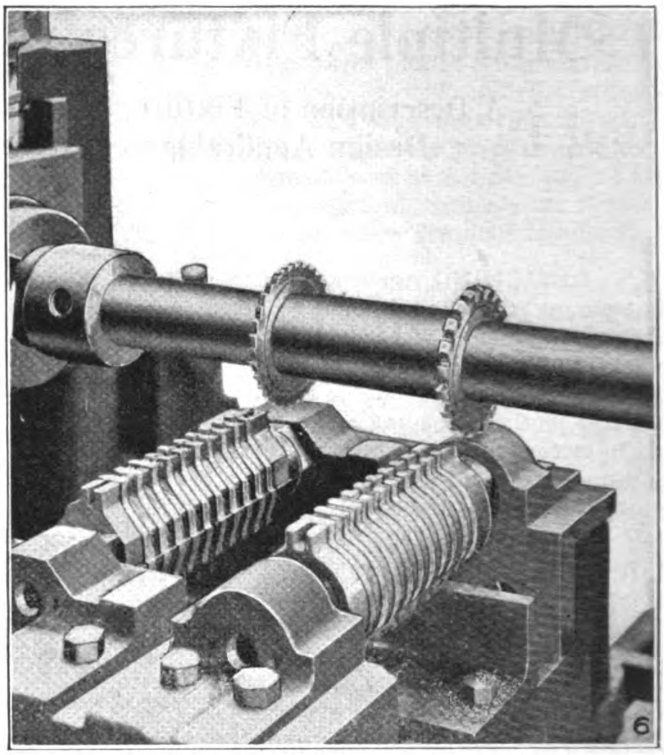


FIG. 4—THE VISES FOR HOLDING THE ARBORS

The plugs, *C*, are made of steel and turned to fit the bore of the shuttle race. At an angle of 15 deg., to suit the race, a hole is reamed in each of these plugs, after which, stems *D*, made of hardened drill rods, are driven into place. The plugs are then doweled into position on the fixture.

On the opposite side of the fixture, seven steel blocks *E* are fastened to the strip *G* by ¼-in. filister head screws. The position of this strip and the method of attachment to the body *B* is shown more clearly in Fig. 1. The steel blocks *E* contain shoulder pins, *F*, which are





FIGS. 5 AND 6—FORM MILLING AND SLOTTING OPERATIONS ON SHUTTLE RACE COVERS

backed up by coil springs held in the blocks by means of headless screws *L*.

Attached to the body of the fixture by means of the shoulder screw *J* is a cam *I* which has a rise of ¼ in. In operation, after the fixture is loaded, the handle *K* is raised and brought toward the arbor, as shown at the left of Fig. 1. As the handle *K* is raised, the cam *I* slides the strip *G*. The pins *F* are thus brought against the shuttle races, holding them in position against the gage blocks *H*. The springs in the blocks *E* take up any variations in the shuttle races and keep the cut from chattering.

Before proceeding to the description of the other fixtures, it might be well to mention at this point that each shuttle race is fitted with a race cover which must be milled not only to form to fit the race *A*, but must also be slotted. For these operations the fixtures illustrated in Figs. 3, 4, 5, and 6 have been devised for use in two Lincoln type milling machines.

In Fig. 3, on a stand of convenient height, is shown a loading fixture. It will be noticed that each arbor holds ten race covers and nine spacers. These are held securely on the arbor by a locking washer and a ¾ in. nut. The locking washer, like the race covers, is milled to form. The arbors are loaded and placed in this fixture between centers. The nut is then tightened, the race covers resting on two parallel strips, one on each side, which locate the race covers on the arbors. The spacers have a small key which fits in a keyway on the arbors. This arrangement brings them always to the same position on the arbor.

In Fig. 4 a loaded arbor will be seen, as well as the vise for holding the two arbors. It will be noted that the arbors have a square on one end. This square is a snug fit in the gage plates on the loose jaw of the vise. Both jaws of the vise have a pair of bell centers which fit the centered end of the arbors. Having loaded the arbors, the first operation on the race covers is that of milling to form and to length as shown in Fig. 5.

Two arbors are placed in the vise and a cut is taken. As the two cutters are different in form, after the first cut is taken, the position of the arbors is reversed and a second cut is made. A newly loaded arbor is then put into the vise, leaving one of the arbors in for a second cut only. It will be seen that at each cut from this point onward, ten covers are completely formed and milled at each cut of the machine.

The next and last operation is illustrated in Fig. 6. Here is shown another view of the vise illustrated in Fig. 5 and also the method of setting up for milling two slots of different widths in these same covers. The procedure is identical with that just described. In the work of milling the race covers a total of five arbors are used. Four are in the two machines while a fifth arbor is unloaded and loaded by the operator while the cut is being taken, the one operator running both machines. Chips are blown from the centers and gage points by air. This fixture not only increased production, but insured the milling of the slots at right angles with the form. To obtain this result had always been one of the difficulties of the old method where the slots were milled one at a time.

Methods of Machine Tool Design

Continuing the Subject of Machine Tool Feed Mechanisms—Design of the Drum Cam Roller—Devices for Eliminating Lost Motion

BY A. L. DELEEUW
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THE roller used with a disk cam should be of cylindrical shape. Being of this shape it will always have a straight-line bearing on the cam and the length of this bearing will be equal to the thickness of the cam if the thickness of the roller is not less than that of the cam, which never should be the case. As to the diameter of the roller, this should be made as large as possible and it should run on a stud as small as possible so that it will be free to turn against the friction between roller and stud. On the other hand, if we make the diameter of the roller large we shall lose considerable time when the roller must pass over the point of the cam or anywhere where the curvature of the cam changes.

Our problem, then, is to select a roller which is large enough to turn freely and yet small enough so that no more time is lost than necessary. Though in one way it is advisable to make the diameter of the stud small, on the other hand, sufficient amount of surface must be retained so that there will not be excessive friction between roller and stud. Thus, the pressure per unit surface will not be so great that the lubricant is entirely squeezed out.

The problem of the cam roller when using a disk cam is not a very serious one as compared to what we meet when we use a drum cam. In Fig. 177 a drum cam and roller are shown in which the roller is made of conical shape. If we should consider that the left side of the cam groove is rubbing against the roller and if we imagine that the groove is at right angles to the axis (which is only the case when there is a dwell in the cam), then the action between roller and cam is the same as that between two friction rollers and their surfaces should be made like the pitch surfaces of a pair of bevel gears, which is the way they are shown in the illustration.

In Fig. 178 a cam drum is shown with a groove running parallel to the axis, which can never be the case where the cam drives the roller, but which may happen when the roller drives the cam. In this case it is obvious that the roller should be of cylindrical shape.

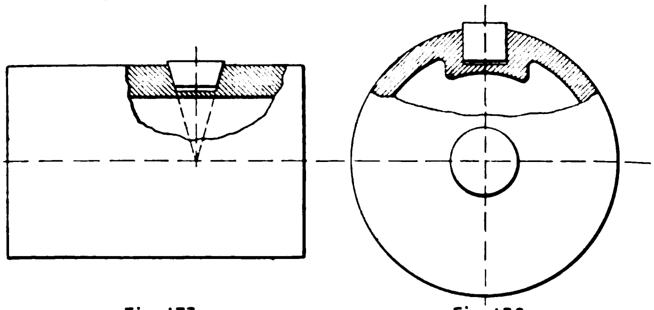


Fig. 177 Fig. 178

FIGS. 177 AND 178—SECTIONS OF DRUM CAMS AND ROLLERS

In ordinary drum cams, parts of the groove may be as in Fig. 177 but the greater part will be at more or less of an angle with the axis. In that case neither the conical nor the cylindrical roller will give entire satisfaction. If in Fig. 177 we had used a cylindrical roller we would have had the following conditions:

Supposing the depth of the groove to be one-fourth of the radius of the drum, then the speed of a point at the top of the groove would have been 4, while the speed of a corresponding point at the bottom would have been 3. As all the points of the surface of a cylindrical roller run at the same speed, there must have been slippage between roller and cam. This slippage would soon wear a flat place on the roller which would prevent it from turning. As soon as this happens the wear would increase and the roller as such cease to function. In order to see what happens when the cam groove is at an angle with the axis, we will take a concrete example. Imagine a cam of which the groove has a depth equal to one-fourth of the radius and with an angle of spiral of 45 deg. When we speak of an angle of spiral in a case like this, we must indicate at which point of the depth of the groove we consider this angle to be, for the angles of spiral of top and bottom of the groove are not the same. In order to find the angle of spiral we would take the circumference of the drum at that point as the base of a triangle, the lead of the spiral as the other right-angle side, and the hypotenuse would show the angle of the spiral.

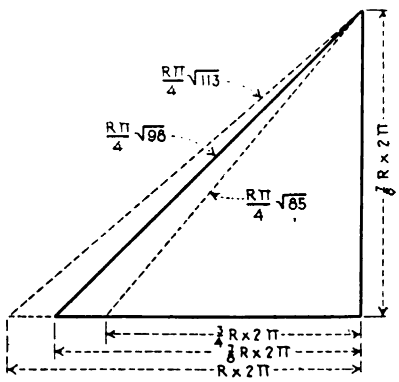


FIG. 179—DIAGRAM TO SHOW VARYING ANGLES OF SPIRAL AT DIFFERENT DEPTHS OF CAM GROOVE

The lead being the same at top, bottom or center of the groove, but the circumference at these points different, we will get different angles of spiral. As a rule, the angle of spiral is given for the center of the depth of the groove or, as it is sometimes called, at the pitch circle. However, there is no reason to give it this name, nor is there a good reason to base our calculations on the angle at that particular point. As a matter of fact, it is safer to consider the angle at the bottom of the groove because at that point the angle is steeper.

Such a triangle as was mentioned before is shown in Fig. 179. The full line triangle is the one we would obtain at the pitch point. As the outside radius is R and the depth of the groove is $\frac{1}{4}R$, the radius at the pitch point will be $\frac{7}{8}R$. The length of the hypotenuse is shown for top, bottom and center of cam groove and we see not only that they are different but also that the length of the hypotenuse at the pitch point is not

the mean between the other two lengths, so that even a conical roller could not engage this cam groove without slippage. This slippage, however, would be considerably less than it would be if we had made the roller cylindrical in form.

Of course it would be possible to construct a roller of such a contour that there is no slippage. In the case illustrated, the top, center and bottom diameter of the roller would have to be in ratio of $\sqrt{113}$; $\sqrt{98}$; $\sqrt{85}$. A number of other points could have been calculated or graphically determined and a roller could have been constructed which would not slip. If such a cam groove should go on without ever changing its direction or lead, such a roller would act without slippage. A cam groove must, however, necessarily return to its starting point, so that there will be a point somewhere where this same spiral is no longer used and therefore where there will be slippage between roller and cam.

If we should have a cam of which the groove goes around one-half the drum without changing its angle of spiral and if then it should at once return to its starting point with the same angle of spiral, we would have an ideal set of conditions so far as the action goes between cam and roller. Such a set of conditions, however, hardly ever occurs in practice. The ordinary cam will have part of its groove at one angle, other parts at another, still other parts running at right angles to the axis, etc., so that the only thing left for us to do is to make some compromise in regard to the shape of the roller. Where we know the exact functioning of a cam we can select that part of the groove where the hardest work is done or perhaps where the groove is of the steepest angle, possibly both, and make the roller conical and with an angle to suit this particular part of the groove. Even then, we should favor the top or larger diameter of the roller so as to have the slippage take place on the smaller part.

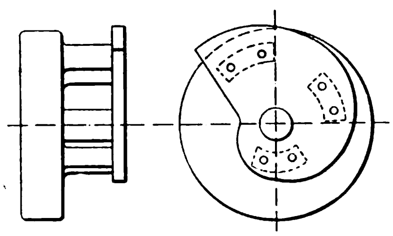


FIG. 180—METHOD OF ATTACHING FACE CAM TO GEAR

Where a cam may be used for different jobs and especially where a cam is built up for various jobs by attaching straps to a drum, so that we may be confronted with almost any angle, a practical solution of the problem would be to give the roller, which by the way is never changed no matter what the groove may be, the form of a cone with an angle corresponding to a strap angle of 30 deg. with the axis.

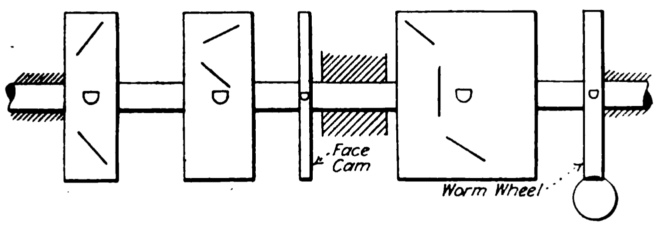


FIG. 181—METHOD OF DRIVING GROUPS OF CAMS

It is sometimes recommended to make the roller slightly barrel shape. This is a good solution where the work is very light but not where the work is of a heavy nature because the barrel-shaped roller provides only a single point of contact between roller and cam.

A single cam may be driven either by a shaft to which it is keyed or fastened in some way, or by a direct drive. Where the cam performs a light duty only, or where its movement does not need to be strictly uniform and without shocks, a shaft drive is acceptable. As a rule, a gear or a screw is loaded fairly uniformly and, if there are fluctuations, they are seldom sudden or periodical. A cam, on the other hand, has a nonuniform load, and, in the nature of things, the load is periodical; that is to say, the changes of load go through a definite cycle and recur in the same order for every revolution of the cam. If a gear is mounted at the end of a long shaft which is driven at the other end, there will be a certain amount of wind in the shaft which is zero at the moment we start to drive and which very soon comes to a maximum. From then on the amount of wind is either constant or changes only slightly and slowly. This is not always so but is true of the great majority of cases. If a cam should be mounted at the end of a long shaft of which the other end receives the driving gear, the amount of wind in the shaft would change with every change in the angularity of the cam and with every change of load. As a result, a cam would have a jerky motion and its action would lack uniformity. For this reason cams should not be mounted far from the source of driving power and, if it is not possible to avoid this, the shaft should be made very heavy so as to minimize the amount of wind.

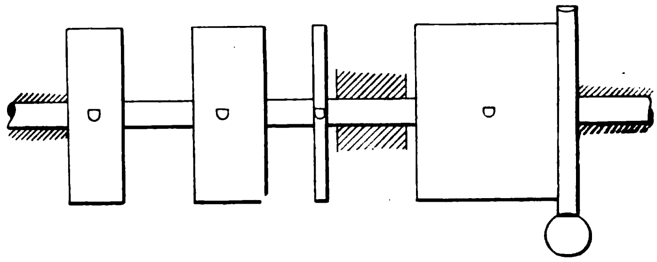


FIG. 182—ANOTHER METHOD OF DRIVING GROUPS OF CAMS

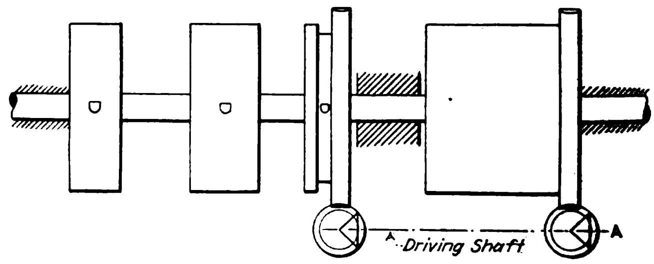


FIG. 183—A THIRD METHOD OF DRIVING GROUPS OF CAMS

The shaft drive is permissible for cams which perform secondary operations and where uniformity of action is not essential, as well as where the sudden jerky movement cannot affect the work. But for cams which are heavily loaded or which are called upon to produce accurate work, such as the main feed cams of automatic machines, a shaft drive is not permissible. In such cases the cams should be driven directly. This may be done by fastening a spur or bevel or internal or worm gear directly to the drum. Where a face cam must be driven and where it is not possible to fasten it directly to a gear because the roller might interfere, an element may be introduced between cam and gear to provide the necessary clearance. Fig. 180 shows the manner in which a face cam might be attached to a gear and provide sufficient clearance for roller or lever or whatever element might interfere. It is hardly necessary

to show how a drum cam can be fastened to a driving gear.

Not only should the cam be directly driven but the designer should see to it that the driving gear is large in diameter, if possible larger than the cam, and if not possible, as near the size of the cam as it can be made. In no case should it be much smaller than the cam.

When there are a number of cams in one machine it is customary to place as many of them as possible on a single shaft and either drive the shaft itself or else drive one of the cams, transmitting this drive through the shaft to the other cams. This is permissible when none of the other cams are called upon to do heavy work. Here again we would have the shaft drive for all of the cams but one. When there is more than one cam in the machine which must have a steady motion, each of these cams should be driven separately by being attached to its own gear. This does not prevent them from being placed on the same shaft if this will lead to simplification of the construction.

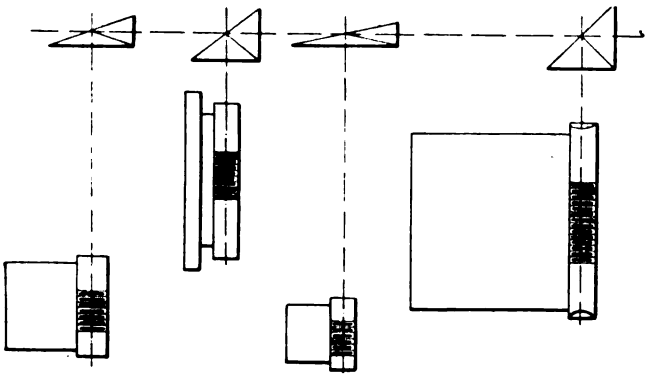


FIG. 184—ARRANGEMENTS OF INDIVIDUAL DRIVE FOR IMPORTANT ELEMENTS

Fig. 181 shows a number of cams all keyed to the same shaft which is driven at one end by means of a worm and worm wheel. Fig. 182 shows a somewhat better construction in which the drum cam is directly attached to this worm wheel, while the other cams are keyed to the shaft. In Fig. 183 is shown the same arrangement again but here it is supposed that the face cam also must have a smooth and uniform motion. It is keyed to the shaft, whereas the large drum cam is running loose on it. All the other cams are also keyed to the main shaft. The two important cams, the large drum cam and the face cam, are each provided with their own worm wheels and the worms are driven by sets of bevel gears which derive their power from shaft *A*. As the number of teeth of bevel gears and worm wheels are the same for both cams, they will run in unison. As a consequence, though the drum cam is not keyed to it, it will not have any movement in relation to the shaft. We might have keyed the drum cam to the shaft, leaving the face cam loose, but with the arrangement of cams as shown in the sketch, this would have brought a larger part of the shaft in torsion than with the proposed arrangement. Generally speaking, that cam should be keyed to the shaft which is nearest to the secondary cam.

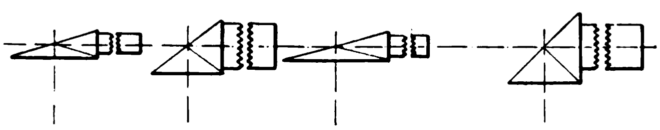


FIG. 185—ANOTHER ARRANGEMENT OF AN INDIVIDUAL DRIVE FOR IMPORTANT ELEMENTS

It might be asked why both cams are not keyed to the shaft. This should not be done because there is no absolute uniformity either between the two worm wheels or worms or the gears driving them. These little errors would cause one of the two cams to take the lead over the other at some point of the cycle, while at another point these conditions may be reversed. This would cause the very twist in the shaft which we aim to avoid.

In many automatic machines, particularly those constructed for some special purpose, one will find a number of slides or other elements carrying tools, all of which must have a smooth and uniform motion. In such a case, all of them should have their own individual drive. Fig. 184 shows such an arrangement. As will be seen, each cam has its own worm wheel but, as not all cams have the same size, it is not necessary to make all worm wheels of the same diameter. It is necessary that all cams should run at the same speed and make the same number of revolutions per minute. This may be accomplished by giving the sets of bevel gears used for the various cams different ratios. This is shown in Fig. 184.

Not only is such an arrangement correct because it gives the proper kind of drive to each of the cams but it is also a very elastic arrangement and can easily be designed in such a manner that any number of cams may be thrown out of action so that small cams may be used where otherwise large ones would be required. As a rule, a large proportion of all the cams used in such a machine is idle, thus requiring a large cam for a small field of action. By modifying the construction, as shown in Fig. 185, we obtain the condition by which small cams can be used, which lends itself to the construction of a program machine, and which permits of many changes of jobs without the necessity of revising the camming of the entire machine. A change of work might require the changing of a single cam with this arrangement, whereas with the ordinary arrangement a change or at least an analysis of all of the cams is necessary.

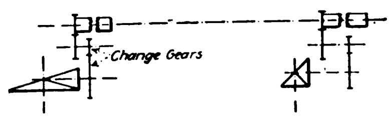


FIG. 186—A THIRD ARRANGEMENT OF AN INDIVIDUAL DRIVE FOR IMPORTANT ELEMENTS

A further improvement, which would make such a machine more universal, is shown in Fig. 186. In the arrangement of Fig. 185 all cams were supposed to run at the same speed. This, however, is not absolutely necessary. It would have been possible to select the bevel gears or worm gears so as to obtain different speeds for the various cams, thus giving each cam a cycle in keeping with the work it has to do. When the machine is once arranged, the relative length of these cycles cannot be changed. It would be possible to speed up or slow down all of the cams but not to change their relative speed. This condition is improved by the arrangement shown in Fig. 186 where each cam may be driven at any speed within a certain range by change gears. It should be noted that such an arrangement permits the running of all cams at the same time, or each cam separately, or any combination. A machine built with such a system of cams may be considered as a group of machines which are only connected by a common source of driving power, by a common feed shaft, and by a common system of control.

Mention was made of the fact that a shaft drive is

not desirable on account of the jerky motion due to wind or twist of the shaft. There is another item which affects the smooth and even motion of the cam and that is the fact that in a drum cam the roller can never completely fit the groove; in other words, that we have lost motion. This lost motion becomes especially visible when the direction of the cam changes, for instance, when it goes over from feed to return, or vice versa. It also becomes visible when the cam changes from slow to fast, or vice versa. This is so well recog-

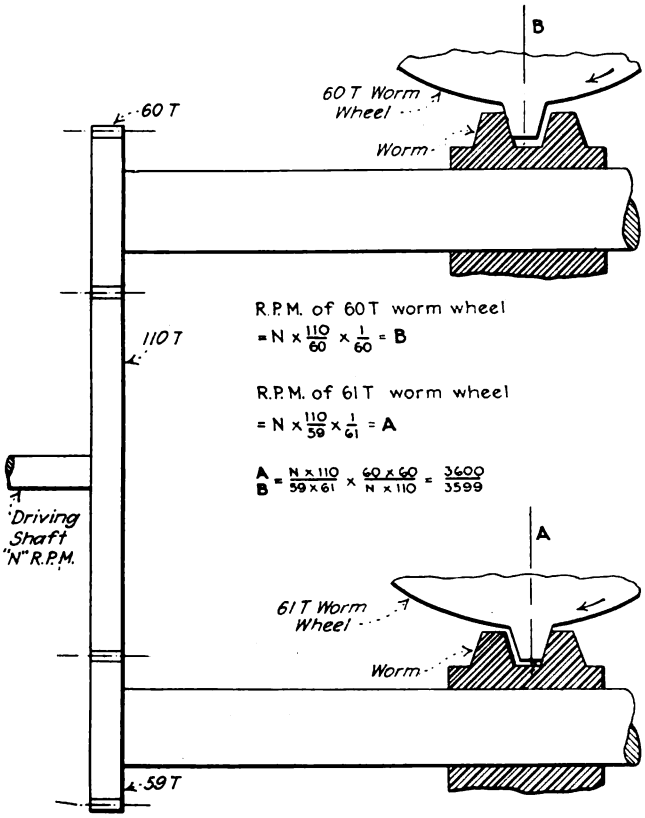


FIG. 187—WORM DRIVE WITHOUT LOST MOTION

nized that it is customary to put a guard strip on a drum cam opposite the acting cam strip. A rapid advance of a turret slide, for instance, may involve so much momentum of the sliding parts that the turret would go entirely too far and the tools might smash into the work if there were no such guard strip. In the great majority of cases such a guard strip is all that is required to counteract the effects of lost motion. There are cases, however, where much greater smoothness of action is required than can be obtained by this means. In such cases springs or weights may be used to hold the roller against the active side of the cam whether this be a drum cam or a face cam.

When all this is done, there still remains another source of lost motion which, as a rule, does not need to be considered seriously, but which, in a few instances, should be taken care of. We refer to the lost motion between worm and worm wheel or between pinion and gear driving the cam. In cases where a particularly smooth motion is required, nothing but a worm and worm wheel would be considered fit for the drive, so that we need to look at this kind of gearing only when we consider how to overcome whatever lost motion there may be left.

There are, of course, a number of ways in which the lost motion between a worm and worm wheel is supposed to be taken up. The worm may be brought deeper into mesh or the worm wheel may be made in two halves bolted together and so arranged that one half can be shifted a slight amount in relation to the other half, or the worm may be made on a taper so that it can be brought deeper into mesh by being moved in an axial direction. None of these methods overcomes entirely the lost motion because they all take for granted that the wear in worm and worm wheel has been even. This is never entirely the case and certainly not with a cam drive, because the pressure required at various points of the cam is not alike and the wear on the worm wheel cannot be expected to be even all the way around. In such cases, where extraordinary smoothness of action is required, some device should be used which will take care of uneven wear and do it automatically. Fig. 187 shows such a device in diagram. Before describing it it may be well to analyze it along the line of thought one should follow when confronted with such a problem. The analysis will show how the realization of the requirements of a problem necessarily and automatically leads to a solution.

The situation is this: We must not have any lost motion between worm and worm wheel, notwithstanding that both may have uneven spacing of the active sides of the teeth, due to wear or to initial inaccuracy. The natural solution is to prevent the worm wheel from moving backward, meanwhile permitting it to go forward. This might be done by wrapping a rope around the hub of the wheel and attaching thereto a weight heavy enough to prevent the wheel from rebounding whatever may be its tendency to do so. This solution is not practical if the machine must run all the time because the length of the rope is necessarily limited. Such a device *might* be useful if the machine were to make only one or two turns. In that case we would wrap the rope around a drum which can be fastened to the worm wheel. When the machine has made its specified number of turns we would unclamp the drum from the wheel, re-wind the rope on the drum, and fasten this once more to the wheel and then resume operations. For the continuous operation of the machine some other device must be designed.

Another means to prevent backward movement and which suggests itself at once, is friction. If sufficient friction is brought to bear against the wheel there will be no possibility of such backward movement and at the same time it will not prevent the wheel from going forward provided there is sufficient driving power. The objection to this scheme is that much power is lost and that this lost power causes wear of the parts, besides making it necessary to proportion all driving parts on a much larger scale. We would have to double the pressure against the worm wheel and lose at least 50 per cent of the power. This seems to condemn the scheme until we remember that the friction member does not need to be stationary but may revolve as well as the worm wheel. The only requirement we must meet is that this friction member

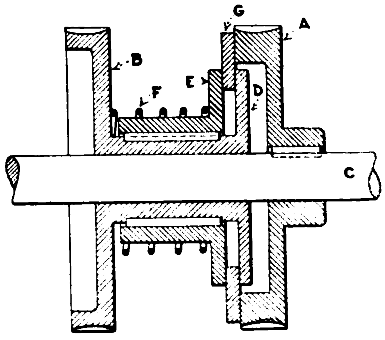


FIG. 188—SKETCH TO SHOW PRINCIPLE OF FRICTION RETARDED WORM

should run somewhat slower than the worm wheel. The difference in speed may be very small because the unevennesses in worm and worm wheel which cause the lost motion are never more than a few thousandths of an inch. This suggests the use of two worm wheels, one fastened to the spindle (or whatever device must be driven), and the other containing the friction device, which will prevent the backward motion.

Fig. 187 shows how such a device would work. *A* is the acting, and *B* the retarding worm wheel. A tooth of *A* will bear against the left side of a tooth of its worm, if the drive is in the direction of the arrow. *A* will take *B* along by friction and will make a tooth of *B* bear against the right-hand side of a tooth of its worm, if this worm stands still or, speaking in a more general way, so long as this worm turns slower than it should to give *B* the same speed as *A*

This leads to the construction shown in Fig. 188. *A* is the acting worm wheel which is shown here as being keyed to a shaft. It might as well be fastened to a spindle or a cam drum or to any other member. *B* is the retarding worm wheel which is fastened to a sleeve provided with a friction plate *D*. Keyed to this sleeve in such a way that it can slide thereon is the friction plate *E*. The spring *F* clamps the plate *G* between *D* and *E*. This plate *G* is fastened to worm wheel *A*, so that this latter wheel will have a tendency to take *B* along but is prevented from doing so by the fact that the worm which drives *B* does not permit it to run as fast as *A*. Instead of a single spring a number of springs might be employed and, instead of a single plate *G*, the contrivance which is, in effect, nothing more than a friction clutch, might be made of the multiple-disk type. One thing should be kept in mind, and that is that the unit pressure between plates must be kept low to avoid abrasion. Attention is called to the fact that Fig. 188 does not show a practical construction but merely the principle of this device.

To avoid undue loss of power by friction and the resulting wear and other undesirable features, we should keep the difference in speed between *A* and *B* to a very small amount. Both wheels being worm wheels we would accomplish this by giving *B* one tooth more than *A;* but even this difference in speed is much more than what is required to make up for the slight errors there may be in the worms and worm wheels. We should arrange the drive so that when *B* makes a large number of revolutions, *A* makes one revolution more. For instance, we might have *B* running 1,000 and *A* 1,001 revolutions in the same time. We see at once that this cannot be accomplished merely by the difference in teeth of the two worm wheels and we will have to employ some other gears. If we introduce one additional gear ratio both systems *A* and *B* will have a speed depending on the product of two gear ratios. The simplest arrangement would be to place a spur gear on each of the two worms and drive them each by means of another gear. If worm wheel *B* has *P* teeth and the number of teeth of *A* is *Q*, and if we place on the worms spur gears with *R* and *S* teeth respectively and drive them both by means of a common gear with *T* teeth, we will find that when the last-mentioned gears runs *N* revolutions *B* runs $\frac{T}{R} \times \frac{N}{P}$ revolutions; and *A* runs $\frac{T}{S} \times \frac{N}{Q}$ revolutions so that the speeds of *B* and *A* bear the proportion $\frac{T}{R}\times\frac{N}{P}$ to $\frac{T}{S}\times\frac{N}{Q}$ or as *QS* to *PR*.

We must find, then, two products both large and differing very little. As all the factors of these products are integer numbers (because they represent the number of teeth of gears), the smallest difference we can have is 1. We might construct all kinds of products which differ 1, such, for instance, as 1,000 and 1,001. the first one being the product of, say, 25 and 40; and the latter of, say, 13 and 77. We wish to have the numbers of teeth of the worm wheels close together and we happen to remember that a square as well as a square minus one can always be factored. For instance, we might choose 2,500 and 2,499, the first one being the product of 50 and 50, and the latter of 51 and 49. Fig. 187 shows *B* with 60 teeth, *A* with 61, while the worms are driven by gears of 60 and 59 teeth respectively. Thus the speed ratio of the two wheels is as 60×60 to 59×61. In other words, *B* will make 3,599 revolutions while *A* makes 3,600, and the work lost by friction is due to one revolution in 3,600. Any other combination might be made and might even be more desirable according to circumstances. It should be noted that the common driving spur gear is shown here to have 110 teeth. This number, however, is entirely immaterial and has no effect on the final ratio.

Attention was called to some arrangements of cams by which some of the secondary operations were performed by a cam which made one-half or one revolution by the application of a single-revolution clutch. This is in principle nothing else but an application of small cams individually driven. In our discussion of such cams we imagined them to perform rather lengthy operation and doing this while the other cams were standing still. There may be many operations in automatic machines which require a very small amount of time, so that their cams can be directly attached to a rather fast-running shaft. The total time occupied by the operation of such cams may be but a very small percentage of the time required for the complete cycle, so that it is hardly worth while to interrupt all the other operations while this particular operation takes place. An instance of this kind is the Brown & Sharpe automatic screw machine where such operations as the shifting of belts, opening and closing of chuck, and stock feed are performed by the single-revolution clutch while the main cam keeps moving.

The action of the cam should be transmitted to the member which is to be moved by the most direct method possible; that is to say, either the cam or the roller should be attached directly to that member. As a rule, it is the roller which is thus attached, but it may just as well be the cam. An instance of this latter construction may be found in the Cleveland automatic screw machine where the cam moves together with the turret. In most other screw machines the cam is held in a fixed position and the roller is attached to the moving part. However, there is no reason why one construction should be selected above the other, except for some advantage to be gained apart from the merits of the transmission itself.

In many machines in which cams are used, in fact it may be said in most machines, there is some intermediary member between cam and the part to be moved, a lever, or slide, or possibly a combination of both. In a great many machines such a construction is not objectionable but in machine tools where it is essential to avoid as much as possible all sources of weakness, all sources of deflection or spring, and where it is desirable to have the tool slides or work-holding members move

with the greatest possible uniformity and smoothness of action, all intermediary members of this nature should be avoided. This rule does not apply when the member to be moved does not perform primary duties, such as guiding a tool or controlling work. Where it is used for trips, the placing in position of stops (but not the accurate location of stops), for closing chucks, feeding stock, etc., we really have the same conditions as we find in automatic machines outside of the machine-tool class and intermediary members are permissible.

Where the conditions of the machine seem to make it unavoidable to use such intermediary members, they should be made exceedingly heavy. The lever should be made with heavy arms and very large bearing for fulcrum, with heavy connections, in fact, everything calculated to minimize deflection, twist, and lost motion; and wherever possible a take-up for wear should be provided. We say "When it *seems* impossible" to avoid such a construction; because it is very seldom indeed that the designer cannot entirely avoid it if he has made up his mind to do so and if he is not afraid to bring a portion of his gray matter into action.

Apprenticeship, Old-Fashioned and Modern

By John S. Watts

Observation of the results of the modern type of apprentice training departments leads me to the conclusion that some of the methods used in training apprentices, while highly efficient in turning out young mechanics who can execute good work of a character with which their teachers have made them familiar, are not as successful as the older ways were in making mechanics who could think out for themselves the solution of some new problem.

The apprentice in an apprentice training department today is taught by doing a job under the direct supervision of his superior who teaches him by showing him in detail just how to proceed step by step, until by practice he is able to execute the job. Sometimes alternative methods of doing the same job may be spoken of, and reasons given for using the method taught; but even if this is done the apprentice in his effort to execute the work in the particular way shown him is not likely to remember much of anything that has been said that did not bear directly on the operation as he was being taught to perform it. In effect this method of tuition is really more a matter of drilling, using the word in its military sense, than it is of educating, and in this to my mind lies its weak point. Because it forms in the mind of the apprentice a habit of depending upon someone to show him how to handle any new jobs, whereas real education means the training of the ability to solve one's own problems by a process of reasoning based upon data observed or previously learned.

There can be no doubt that a long continued course of tuition under the method of teaching by detailed demonstration, will sap the students powers of independent reasoning, because of the lack of exercise of this power, until in the end he becomes unable to attack a job with which he is not familiar without someone to show him the correct procedure. Time and again have I known this class of men to ask for information from pure habit, while at the same time they had in themselves all the knowledge that was required. They lacked the ability to apply this knowledge to a different problem, or it might in some cases be more correct to say that they had not cultivated a confidence in their ability to reason from known facts.

In those ancient days when I served my apprenticeship, there was no such animal as an apprentice instructor, and it seems to me now that the general idea was that if a boy worked for four or five years in a machine shop, he would become a machinist if he was fitted for it, by the mere working with mechanics and breathing the atmosphere of a machine shop. Certainly there was no manner of method used to train or educate him, and if he failed to become a skilled mechanic in that period of time the fault was deemed to be in himself, in that he was not capable of becoming one.

For the benefit of the younger men, I may say that the general routine of an apprenticeship in those days, that is, up to about twenty-five years ago, was that during the first six months practically the whole time of the apprentice was spent in running errands, carrying tools, and cleaning up the machines. Whenever it happened that a new apprentice was taken on, the older one was "promoted" to assisting the journeymen on the heavier machines, with an occasional very simple job to do on his own. Even when the apprentice was given a job to do, he was merely told what was wanted and expected to go ahead and do it entirely on his own initiative.

As he struggled along he gradually became aware that everyone in the shop was keeping an amused eye upon him, and an attack of stage fright was added to his other troubles. If the youngster showed the mettle that was in him and really tried his best, exhibiting a reasonable amount of intelligence in tackling the job, allowing for his inexperience, some one or other of the men would give him a hint in passing to put him on the right road. But if the boy had been stuck up, a snob, or otherwise displayed obnoxious tendencies in the shop, or did not handle himself as well as his previous opportunities of observing other men's work should have enabled him to, woe betide him, as he would be allowed to go his own way even to the destruction of the machine.

Granted that this way was a cruel, hard and slow one, still the youngster when he finally got the job done had found out himself how to do it, and had also learned by actual experience what troubles to look out for and what should be done to avoid them. Moreover having discovered this information by the sweat of his brow, he was little likely to forget it. We all know that knowledge gained by personal effort becomes a part of ourselves, unlike that imparted to us by others, which is apt to be forgotten, and in any case is not so thoroughly well understood. Incidentally the repetition of this struggle with each new job, forms an excellent training for the character, leading as it does to an increase in the eminently useful virtues of self-reliance without conceit, of reasoning and foresight.

My purpose in writing this is not to advocate a return to the old system, but to suggest that the new apprentice training schools, while undoubtedly efficient in turning out trained mechanics in a short period of tuition, are not as efficient as the old way in making all-around workmen who could turn their hand to any job within their trade. My point is that it would be better to take a little longer to educate the boys, instead of training them to a parrot-like ability to repeat what they have seen done.

The New Tariff Act

Significance of Elastic Sections—Their Effect on Exports and Imports—Changed Status of Tariff Commission

By R. B. ROSS
Associate Editor, *American Machinist*

THE tariff controversy—will it ever end? Small wonder is it that the American business man has asked this question so many times within the past eighteen months or more. The daily press, the weekly and monthly periodicals, the trade journals—all have staggered under a heavy burden of widely divergent views and comment.

Even today with the bill passed and spread upon the statute books, the average citizen, emerging from the bewildering maze of partisan or sectional argument pro and con, wonders what good, if any, has been accomplished. It is with difficulty, if at all, that he has been able to discover what improvements have been made, how far reaching they are, and what their effect will be if carried out in a broad spirit of equity and justice.

Divesting the bill as passed of any partisan aspect; disregarding whatever charge may be set up that special interests have been favored; and leaving out of the discussion the question of the soundness for the basis of the rates and their effect on living costs, it is, perhaps, worth while to examine the document as a whole. What new features does it contain? Do they, or do they not, mark progress? What new powers have been prescribed, in whom are they vested and what new organization and method of procedure has been provided for?

Gives President Broad Powers

Briefly, in the new tariff act there are three outstanding provisions which are new and which mark a distinct advance in tariff legislation. These three provisions are contained in Sections 315, 316 and 317 of Title III of the act, which covers special provisions. It was these sections that President Harding had in mind when, at the time of his signing the bill he said, "If we succeed as I hope we shall succeed, in making effective the elastic provisions of this bill, this will prove the greatest contribution toward progress in tariff making in a century."

The first of these new provisions, Section 315, has come to be known as the flexible or elastic tariff section. Under it the President has been vested with powers which are almost plenary in character. He is vested with power to change the classification of any article or commodity set forth in the act. He is vested with power to substitute American for foreign valuation in the case of articles which are made subject to *ad valorem* duties. He is vested with power to raise or lower the duty on any article or commodity in an amount not to exceed 50 per cent of the rates specified elsewhere in the act. All this, however, is dependent upon recommendations made to the President by the Tariff Commission. At this point it is interesting to note the enlarged scope of the work of that body.

Under Section 315, and, for that matter, under Sections 316 and 317 also, an application or petition for action or relief may be made by any person, partnership, corporation or association. If the application be made and found in order, and if it disclose to the satisfaction of the Commission that there are good and sufficient reasons for requesting action or relief from existing duties, the Commission may then order an investigation. In this investigation, it is not compelled to confine itself to the issues presented but may broaden, limit or modify the issue as it sees fit. What it will seek chiefly to determine, however, regarding the article or commodity in question, is, to use the words of the act, "the difference in cost of production in the United States and the principal competing country."

If, upon the completion of such investigation it shall be found that an increase or a decrease in the duty fixed under Title I of the act is necessary to equalize the difference in cost of production, the Commission makes its recommendation to the President who is vested, as before stated, with power to take the necessary action.

May Substitute Foreign Valuation

In the case of articles subject to *ad valorem* duties it may be shown upon investigation by the Commission that an increase or a decrease of 50 per cent in the rate will not be sufficient to equalize the difference in production costs. It is then that the President may exercise his power and substitute American for foreign valuation.

The second of the new provisions, Section 316, has to do in the main with goods imported into the United States. It is framed chiefly to provide American industry with a weapon against unfair acts and methods employed by a competing country. In the words of the section, "unfair methods of competition and unfair acts in the importation of articles into the United States or in their sale by the owner, importer, consignee or agent of either, the tendency of which is to destroy or substantially injure an industry . . . shall be declared unlawful."

Protection for Export Trade

Here, again, the Tariff Commission functions to assist the President in making any decisions under this section, in that it is authorized to investigate any alleged violations. If it shall be found by that body that unfair methods are being employed, the President is vested with power to impose additional duty in an amount sufficient to offset such unfair practices. In no case, however, shall such additional duty exceed 50 per cent nor be less than 10 per cent.

The third and last of the new provisions, Section 317, is designed as a measure of protection for American export trade. It may be regarded as the logical outgrowth of the expansion which has taken place in the foreign commerce of the United States in the last decade. Within that period, as is well known, the volume of American exports has increased greatly. Not only has the volume increased but the classes and varieties have broadened. Within this period also, numerous American industries have become dependent to a greater or less degree on other lands for their raw materials vital to the existence of these industries.

It is natural, therefore, that with this great economic change there should come not merely a need but a demand for a more definite, a more stable and a more scientific tariff policy. In formulating Section 317 there has been a reversion to the Tariff Act of 1909 with its maximum and minimum features, and a discarding of the reciprocity policies and penalty duties which marked the McKinley and Dingley bills of the past. The section, however, has been broadened and given increased flexibility.

May Declare Additional Duties

As it now stands, the President is vested with power, "when he finds that the public interest shall be served thereby," to "declare new and additional duties upon articles wholly or in part the growth or product of any foreign country," whenever it shall be found, upon investigation, that such country has granted special favors to the products of a third country, thereby placing American products at a disadvantage in that market. Under this section the President may go even farther. Where it has been found that discrimination has been made against American goods or where, in fact, American goods are not fully accorded equal rights with those of another country, the President may prohibit entirely importations into the United States from the country resorting to such practices.

In one other particular is Section 317 of importance. It provides against preferential export taxes. It vests the President with power to penalize imports into the United States from a foreign country when and where it has been found, upon investigation, that that foreign country has been granted preferential export taxes by a third country.

As a result of these three provisions, Sections 315, 316 and 317, of the new act, a radical change has been made necessary in the organization of the United States Tariff Commission. More particularly under Section 315 is provision made for new and enlarged powers for the commission. Not only does the act provide at this point for issuance by the President of any and all proclamations changing rates or classifications, but it specifically states that investigations to assist the President in ascertaining the points at issue shall be made by the United States Tariff Commission. It also states that "no proclamation shall be issued under this section until such investigation shall have been made."

As far as the Tariff Commission itself is concerned, Section 315 provides for public hearings by that body at which it shall give reasonable opportunity to parties interested to be heard. As a final step in carrying out the details of the procedure, the act authorizes the commission to adopt such reasonable procedure, rules and regulations as it may deem necessary.

Tariff Commission Procedure

Under the executive order issued by the President, Oct. 7, the commission has taken the steps necessary to comply with the act and has issued its rules of procedure governing all applications for investigation and the routine to be followed: It has also organized itself into four main divisions as follows: 1, office of the chief investigator; 2, office of the chief economist; 3, legal division; and 4, secretary of the commission. The chief matter of interest in the organization of the commission is found in the joint offices of the chief investigator and the chief economist. Under the direction of these two chiefs will be eleven subdivisions, each with a chief and several experts in the respective lines as follows: Chemicals, pottery and glass, metals, wood and paper, sugar, agriculture, textiles, leather, sundries, preferential tariffs and commercial treaties, and accounting. It has also provided for the establishment of an office at the port of New York and various arrangements will be made for conducting investigations on the ground in the countries abroad.

On the whole, the new provisions of the Tariff Act of 1922 have created a situation which is certain to be watched with keen interest. The commission has before it a task the size of which it is idle to minimize. Not only will the nation be interested from now on in the manner and method in which it conducts its investigations, but it is certain to scrutinize minutely its every action with respect to the duties levied against the articles and commodities in the fifteen schedules of Title I, now being subjected to much adverse criticism from every quarter.

Are Metal Workers Hidebound? —Discussion

By Alfred Herbert, Ltd.
Coventry, England

The editorial under the above heading which appeared on page 154, Vol. 57 of the *American Machinist* strikes a note which we think is particularly opportune. There is no doubt that the important subject of metal cutting has not received the attention to which it is entitled through its importance as a power user. We ourselves have gone some little way by experiments in connection with tool grinding machines of our manufacture but the subject is such a vast one that we find it impossible to carry out the necessary research and experimental work that it demands.

We do not think that anyone will dispute the statement that for any one metal cutting operation there is one tool which will give the most efficient results, i.e., remove metal at the fastest possible rate with a minimum expenditure of power, but what that tool is there are as many opinions as there are people engaged in metal cutting. It is possible that Professor Coker in his research work, some account of which was given for the Institute of Mechanical Engineers a short time ago, is working on lines which may lead to good results in this direction some time or other, but we would like to suggest that some influential body, such as the Institution of Mechanical Engineers or the National Physical Laboratory, should undertake research work in connection with metal cutting tools in the most thorough way possible.

As an instance of what is possible in this direction, Messrs. Clark & Chapman of Gateshead a few years ago changed over the majority of their lathe tools from the ordinary type to a curved top face type. While they cannot give any definite data on power consumption, they state quite definitely that the amount of power absorbed in their machine shop was reduced by the change. If it is assumed that any one machine at any one operation absorbs say 1 hp., which by change of tool could be reduced to 0.9 hp., such reduction multiplied by the number of machines in this country would very soon show such an enormous saving in power that any research work in this direction would be amply justified.

An Interesting Rack and Gear Movement

The Gear Runs into and out of Mesh with Rack Twice in Each Cycle—While out of Mesh It Acts as a Crank

BY MILTON WRIGHT

AN INTERESTING and somewhat complicated gear and rack movement is that used to reciprocate the "bed" or platen of the Premier printing press made by the Premier & Potter Printing Press Manufacturing Co., Derby, Conn.

The Premier is what is technically known as a "flat-bed" press. The forms of type are locked in position

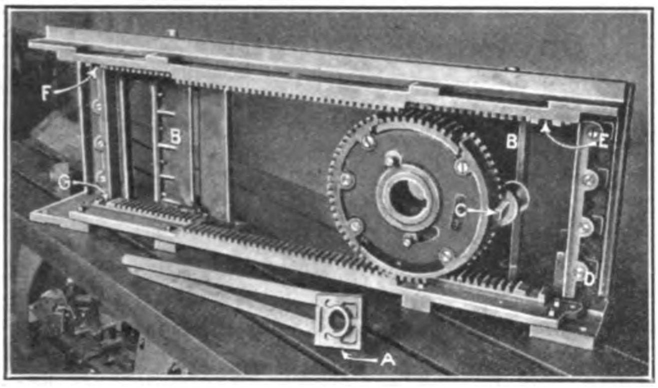


FIG. 1. GEAR AND RACK OF THE PREMIER PRINTING PRESS

on a flat table and caused to pass to and fro under a rotating cylinder that carries the paper upon which the impression is to be made. The cylinder is of such diameter that its circumference matches the length of the bed movement; its peripheral speed, therefore, being exactly the same as the speed at which the type is moving. Any deviation from a true relation in this respect would result in what the printers call "slurring" or smudging the impression.

The cylinder makes two revoltuions for each cycle of movement of the bed; being lifted by cams out of contact with the type as the bed passes back under it to the starting point. The cylinder and bed are not geared directly together and there is no hesitation in the rotative movement of the cylinder, so that it becomes a rather nice mechanical problem to deliver the bed to the swiftly moving cylinder at exactly the right time, place and speed at the beginning of each cycle, and to hold the bed and cylinder together during the entire forward movement as rigidly as if both were stationary.

Not only does this duty devolve upon the parts shown in Fig. 1, but the gear must also shoulder the responsibility of the practically instantaneous reversal of movement of half a ton of metal, and do it without undue shock or jar, twice in each cycle. When it is considered that there are nearly one hundred such reversals each minute an idea may be gained of the nicety with which these parts must function.

The rectangular frame in Fig. 1 is bolted to the under side of the bed and becomes a part of it. For convenience in photographing, the frame is shown upside down in the picture, but as it is entirely symmetrical, with the exception of the pads for the attaching bolts, that condition will make no difference whatever in the relative position of the parts shown, and it may be assumed that its position in the press is the same as in the picture.

The shaft upon the end of which the gear is keyed has no movement other than a rotative one, but, strange as it may seem, it turns *three* times for each cycle or passage of the bed back and forth.

The rack teeth at both top and bottom of the frame are rigid with respect to the latter; being in fact cut from the solid metal of which the frame is built up. The vertical distance between the pitch lines of the two racks is exactly the same as the pitch diameter of the gear, so that were it not for the peculiarities of the latter and the fact that each rack is composed of three sections lying in two different planes widthwise, the gear would be engaged with both racks at once and locked against movement.

Let us first study the gear, both sides of which are shown in Figs. 2 and 3, and the parts disassembled in Fig. 4. From these pictures it will be seen that the gear is twice as wide as the rack; being equal in fact to the combined width of the offset sections. We will note further that for one third of the circumference the teeth extend only half-way across from what we will call the front, (Fig. 2), on another third the teeth extend halfway across from the back, (Fig. 3); while for the remaining third, composed of the two ends of the sliding segment, the teeth extend the full width of the gear.

The sliding segment can be seen to advantage in Fig.

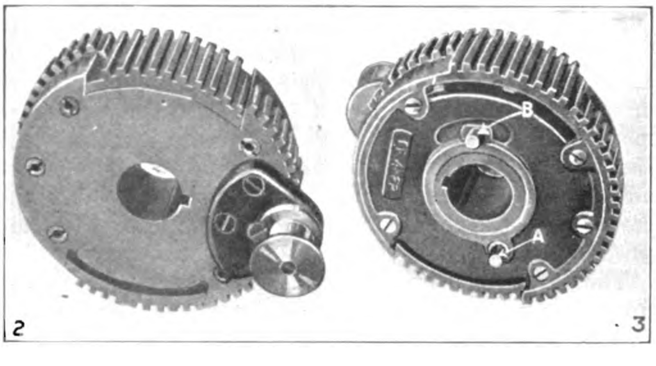


FIG. 2. CRANK SIDE OF GEAR. FIG. 3. COVER SIDE OF GEAR

4, where the cover and the actuating cam are removed. Each end of the segment is a true arc and the teeth cut thereon conform in every respect to those cut from the solid metal of the gear, but the segment itself is shorter than the diameter of the gear by an amount equal to the full depth of a tooth.

The gear as a matter of fact is cut, after assembly, upon an automatic gear cutter in the same manner that an ordinary gear would be cut; the only difference being that at some time after one end of the segment has been cut and before the machine has spaced around far enough to begin on the other end, the operator must happen around and shift the cam that moves the segment from one position to the other. He must also

cause the machine to skip a tooth at a predetermined point, as will be discerned later.

At *AA* (Fig. 4) upon the segment are hardened steel rollers upon which bear the risers *BB* of the actuating cam. The cam itself fits over the hub of the gear with the risers in contact with the rollers. It will be noted that the risers are opposed to each other so that a slight rotative movement of the cam in, let us say, the clock-wise direction will push the segment to the lower position as viewed in Figs. 2 and 4. The lower roller will then be resting on the dwell at the high spot of the cam while the upper roller is at the bottom of the corresponding rise. It is evident that a reverse movement of the cam would send the segment to the opposite position.

The forward and back movement of the cam must be

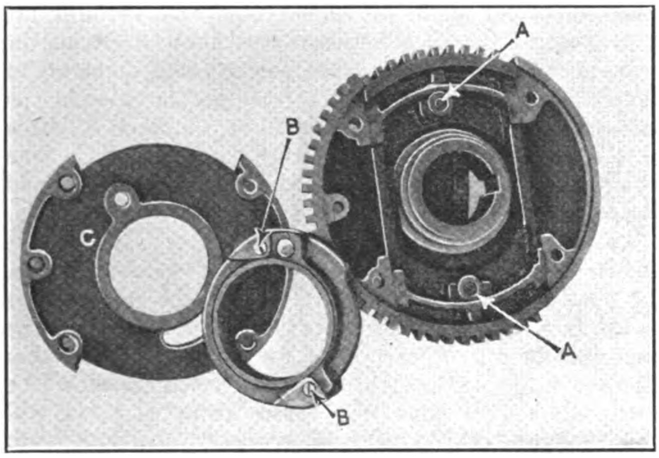


FIG. 4. THE GEAR PARTLY DISASSEMBLED

made twice in each three revolutions of the gear, and to produce such a movement within the constantly rotating gear is not altogether easy of accomplishment. The lever shown in Fig. 5 does the trick.

At *C* in Fig. 4 is shown separately the cover plate that holds the parts of the composite gear together. It is bolted to the body of the gear and becomes a part of it, confining the cam and segment against sidewise movement while allowing the one freely to rotate and the other to slide. A projecting stud, seen to better advantage at *A* in Fig. 3, is driven solidly into the cover plate. A similar stud *B*, driven into the cam, protrudes through the curved slot in the cover.

The lever in Fig. 5 surrounds, but does not bear upon, the shaft that carries the gear, the studs *A* and *B*, Fig. 3, enter the bronze sliding-blocks *A* and *B*, Fig. 5, which are free to move radially in their yokes. The yokes are a part of the ring *C*, which is fitted to turn freely in the shell of the lever. It will be seen, then, that at certain positions in the revolution of the gear, a movement applied at the end of the lever will produce a corresponding but much reduced movement of one or other of the two sliding blocks, while at other positions no movement would result.

The lever is, therefore, alternately of the first and the second class, power always being applied at the end of the lever, the fixed stud being always the fulcrum, and the stud in the cam always the weight to be moved. The fulcrum and the weight to be moved are, however, constantly exchanging positions as the gear and the ring *C* revolve together.

The lever does not at any time move the cam backwards. At certain points in the rotation the cam is moved forward faster than the gear would carry it; at other points it is merely retarded, allowing the gear to run away from it.

The gear is not at all times a gear. One revolution out of every three it is a crank and at these points (one-half revolution at each end of the traverse movement of the bed) it is entirely out of mesh with the rack and has the bed under control of a rigid crank connection by means of which it is enabled to slow down and stop the rapidly moving bed and accelerate it in reverse direction without the slam that otherwise would wreck the machinery at the first reversal. This brings us to the consideration of the complete movement as shown in Fig. 1.

When the press is fully assembled the bronze bearing block *A*, Fig. 1, is permanently located on the crankpin, which may be seen projecting from behind the gear and is held thereon by the removable flange on the end of the pin. The two rods shown attached to the block are attached at their other ends to a free slide and have no other function than to keep the block always in alignment and prevent it from being presented cornerwise to the yokes at either end of the rack frame.

The outer side of each of the above mentioned yokes is formed by the vertical member of the frame at either end; the inner sides are formed by the pieces *BB*, called shutters. Starting with the parts in the position shown in Fig. 1, we will follow through the movements of a complete cycle:

The gear may be considered to be rotating in a clockwise direction and the rack in full movement to the left. As the crankpin reaches its lowest position the right end of the rack frame has caught up with it and the bearing block *A* settles quietly into the lower right-hand corner, at the same time that the big tooth *C* of the gear comes into mesh with the corresponding big space *D* in the lower rack. The shutter *B* at that end, actuated by a stationary cam, closes behind the bearing block *A*, confining it within a fixed yoke, and the gear rolls clear of the rack.

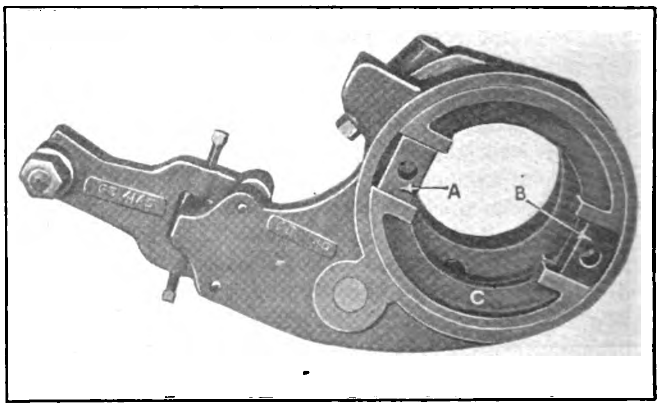


FIG. 5. THE LEVER THAT MOVES THE SLIDING SEGMENT

The gear has now become a crank—without shock to the parts, for all parts are moving in unison. During the next quarter turn of the gear (we will still call it a gear though it is not acting like one) the movement of the bed is quickly slowed until, at just one-half turn of the gear from the position shown in the cut, the bed has come to rest.

From this point the bed accelerates in movement to the right until at the completion of the third quarter turn (from the position shown in the cut) the crank has reached its top position, the big tooth of the gear

(there is but one) is in mesh with the big space *E* of the upper rack. The shutter *B*, released by its cam, now flies open and sets the block *A* free, leaving the rack frame again under control of the gear, which has resumed its normal function.

Now in mesh with the upper rack, the gear sends the frame to the right until, upon reaching the other end of its movement, the block *A* settles into the upper left-hand corner of the frame, the shutter closes and the cycle of movement is repeated, the big tooth of the gear passing out of the upper rack through the space *F* and, upon completion of the half revolution, re-entering the lower rack by the space *G*.

The function of the sliding segment should now be apparent. In the position shown in Fig. 1 the teeth on the upper part of the gear are moving to the right while the rack frame is moving to the left. The teeth of the upper rack have just passed over the blank space of the gear, as well as over the teeth of the withdrawn segment and the first solid tooth of the gear is barely going to clear the first tooth of the middle section of rack, passing at high speed in reverse direction.

When the gear has made exactly one revolution from the position shown in the cut all parts will occupy exactly the same position except that the segment will be in mesh with the upper rack and the frame moving to the right. As the direction of movement of the frame has been reversed, while that of the gear remains the same it is obvious that there should be teeth in the upper part of the gear, but none in the lower part when the swiftly moving rack reaches it.

The shutters *BB* really have little to do, and may be regarded as accident preventers. The press would run as well without them, for the pressure upon the bearing block is always imposed by the outer rigid side of the yoke, first in stopping the momentum of the bed in slowing it to rest, and then in overcoming its inertia during the accelerative period. It would not be safe, however, to run without them, for if by any chance the bed should jump forward out of its true position by the distance of half a tooth or more, the wreckage would be complete.

Learning the Trade Forty Years Ago

BY W. S. DAVENPORT

(The second of four articles)

Well do I remember the hot Fourth of July day, so many years ago, when with the aid of the crude lathe I had constructed and the flat drill of "sleigh shoe steel" made for me by the village blacksmith, I succeeded in boring out the cylinder of my first steam engine.

Fourth of July was one of the few holidays that were observed upon the farm and, after the necessary "chores" were done, the whole family except myself piled into the "carryall" to attend the picnic and holiday exercises, leaving me in my little shop with its home-made lathe and grindstone foot power to devote the day to a matter far more important to me than any mere celebration of a national holiday.

TROUBLE WITH MY LATHE

I could not drive my lathe by means of the pedal and belt to drill such an extremely large hole (it was 1⅝ in.) because it would go too fast and, besides, the belt would slip, so I rigged up a crank on the live spindle and attached a long wooden lever to the tailstock to feed the drill. After a whole day's exertion, during which I lost a great deal of perspiration in my frantic endeavors to be in two places at once, turning the crank with one hand and pulling the lever with the other, I succeeded in getting a hole through the whole 2-in. length of that stubborn casting.

Much to my disgust it was not a very good hole. It was not any too round and, instead of the nice smooth surface suitable for the inner wall of an engine cylinder, it seemed to have a number of rough spiral ridges extending through it. For weeks I tried to study out a way to smooth it up, but in the end I was obliged to take it to the machine shop, seven miles away, where with the aid of a rose reamer in a real lathe it was made true and smooth in a short time.

I managed to face the ends of the cylinder in my own lathe; putting it on a wooden arbor and using a "beechnut" hand-tool that I made out of an old three-cornered file. The heads I machined by holding them in a recessed wooden chuck to which they were fastened by machine screws passing through the chuck from the back. As I look back upon those days I can see that every move was the merest makeshift and that my workmanship was probably very indifferent, but then every piece finished was a triumph that constituted in itself a rich reward.

It was probably a year before that engine was completed, for the only opportunity I had to work upon it was on rainy days and a few minutes stolen each day from the dinner hour; but completed it finally was and I was a proud boy indeed when, after tramping with it to the adjoining town and inducing the engineer of the steam sawmill to connect it to his boiler, I had the satisfaction of seeing it run so rapidly and smoothly.

All good machinists, as I well knew, had tool chests in which to keep their tools, so that winter I set about making one for myself out of a board of butternut wood that I took from a board fence, replacing it, of course, with a less valuable piece of lumber. In making the dovetailed corners of this chest there was a great deal of trying work and many failures, impressing upon me the necessity for accurate workmanship. From that time forward I made it a point to see not how quickly but how well I could do each job.

Having a nice new tool chest it seemed proper to have some tools to put in it, so with much painstaking effort I made several pairs of calipers and a try-square; my materials being broken saw blades and worn-out knives from the mowing machine. Very crude and rudimentary were these early tools, but with each one finished there came the joy and pride of achievement and ownership that has never attended the purchase of much finer tools in a later day.

During the previous summer I had written a letter to the Brown & Sharpe Manufacturing Co. of Providence, inquiring about an opportunity to "learn the trade" with them, and in reply had received a letter (written with a pen and now much prized) from the hand of Mr. Lucian Sharpe himself, in which letter there was enclosed a copy of their terms of apprenticeship. I could not, however, raise the one hundred dollars that was a condition to the indenture, nor did I possess even the means to pay my fare to Providence, to say nothing of living expenses in that city, for at that time they paid but 40 cents a day to boys in the first year.

TABLE II

United States—Imports of Machine Tools*

Country	1915	1916	1917	Fiscal Year Ending June 30th, 1918	July 1st to Dec. 31st 1918 Number	July 1st to Dec 31st 1918 ** Value	1919 Number	1919 Value	1920 Number	1920 Value	1921 Number	1921 Value
Austria-Hungary***	$ 1,829	$.......	$.......	$.......	....	$.......	....	$.......	522	$ 80	36	$ 8,086
Belgium	31,633	....	....	....	....	....	....	....	....	....	....	....
France	2,902	1,526	494	....	....	....	294	1,428	212	6,241	93	6,205
Germany	84,211	....	....	....	....	....	25	91	7,864	74,681	1,234	91,650
Greece	17	....	....	....	....	....	....	....	....	....	....	....
Italy	....	252	....	....	....	....	....	....	....	....	....	....
Netherlands	422	....	....	....	....	....	....	....	5	24,238	2	4,290
Norway	....	....	12,060	....	....	....	....	....	1	191	....	....
Sweden	....	....	13,159	....	34	26,149	....	....	....	....	9	366
Switzerland	2,380	4,457	....	20	....	....	32	73,352	379	222,621	1,041	48,785
England	21,250	30,816	12,541	15,058	15	5,952	1,861	51,013	352	88,963	2,219	26,083
Scotland	1,790	68	1,456	....	....	....	25	1,152	8	435	1	17
Denmark	....	....	....	....	10	86,832	....	....	1	150	....	....
Spain	....	....	....	....	....	....	....	....	....	....	4	1,834
Canada	13,470	73,235	82,547	259,104	89	79,391	1,199	12,192	152	25,050	174	27,309
Honduras	25	....	....	....	....	....	....	....	....	....	....	....
Panama	....	....	....	95	....	....	....	....	....	....	....	....
Mexico	45	....	....	....	....	....	....	....	....	....	....	....
Cuba	89	....	....	....	....	....	....	....	....	....	....	....
Argentina	....	1,620	....	....	....	....	....	....	....	....	....	....
British West Indies	....	....	....	....	....	....	....	....	6	3,098	....	....
China	....	....	....	9,274	....	....	....	....	....	....	3	2,991
British India	....	....	....	180	....	....	....	....	....	....	....	....
Japan	100	423	....	....	....	....	....	....	....	....	....	....
Australia	262	....	....	....	....	....	1	200	....	....	....	....
Union of South Africa	61	....	....	....	....	....	....	....	....	....	....	....
Total	$160,486	$112,397	$122,257	$283,746	148	$198,324	3,438	$139,619	9,501	$446,557	4,816	$217,616

*Included in "All Other Machinery" prior to 1915.
**Number not shown prior to 1918.
***Austria—only after 1918.

Industrial Cost Accounting for Executives—II

Setting Selling Prices—Controlling Methods of Manufacture and Expense Determining Profitable Lines

BY PAUL M. ATKINS

IT WAS pointed out in the first article that it was quite appropriate to give the reader some idea of the benefits to be gained from a well-planned, properly installed cost system before taking him into a discussion of its details. The uses, especially from the executive point of view, have rarely been fully recognized and, when they are, the value of a good cost system to a company will be much more appreciated.

Probably the most commonly accepted idea of the use to be made of cost accounts is as a basis for selling prices. There are unquestionably many cases where this is true, and more frequently, perhaps, in the machine-building industry than in most others. It will occur from time to time that machines are built on a cost plus basis and hence the cost must be ascertained before the selling price can be determined. The cost plus system which received such an impetus during the war proved not to be successful, except within a rather limited range of circumstances, and has now been pretty generally dropped.

There are numerous other circumstances in which the cost records are employed for the establishment of selling prices where the connection is not quite so direct. Wherever bids are made and estimates prepared for the setting of selling prices, the cost records should be employed.

USING COST RECORDS OF OTHER JOBS

It is true that the cost of the actual product, which is being made to fill the order taken, does not enter into the calculations, for the cost cannot be found until after the work has been done. The costs of other jobs of a similar sort, however, are the ones which are used in preparing the estimates or are employed to check the estimates once made.

This use of the cost records will be clearer if we study the matter a little. Material, for example, is usually specified by the engineering department and the quantity per unit or for the entire order indicated. If the material is purchased outside, bids will be obtained or the market price used in estimating the cost. If the material is produced inside the plant, then it is necessary to turn to the cost records to get information about its probable cost.

Whether the material is purchased outside or produced inside the factory, its consumption must be checked by means of the cost records. It is not enough to provide sufficient material for the order if all goes well, but it is necessary to make sure that all probable scrap and wastage is provided for also. This additional material is properly a cost of the order and when an estimate is prepared as a basis for a selling price, its value must be included.

Not only must material be considered but also labor and burden. Without cost records of previous orders, the estimate of these items is likely to be nothing more than a wild guess and wild guesses at any time, and particularly at a period like the present when business is being carried on on close margins, are likely to prove disastrous. An analysis of the business failures in recent months will prove this conclusively. In any business, therefore, where the selling prices are based on estimates and are controlled wholly or in a considerable measure by the executives of the company producing the goods, costs of production are one of the chief sources of information on which the executives may base their judgments.

INDUSTRIES WHERE COSTS DO NOT AFFECT SELLING

While all this is true in regard to many cases, there are more where the costs of production have relatively little or no effect on the selling price obtained by the concern. There is, of course, no hard and fast line separating one class of cases from another. They merge one into another, and often the use of cost records for this purpose will vary in importance among companies and with the condition of the business world. For a very large number of goods which are staples like working shoes, cotton sheeting and certain basic steel products, the selling price is largely determined, if not wholly set, by world-wide market conditions, and not by the act or influence of any one manufacturer.

Cotton sheeting offers a pretty good example of this kind of thing. It is made in this country, in England, France, Germany, India, to mention only a few of the principal producing countries. The price, like that of wheat, is based on the English market. No single manufacturer can raise the price of his product more than a very small amount above the current market price without giving some corresponding advantage, such as better quality, without sooner or later losing his business. For the individual producer, it is a case of getting his cost of production to the point where he can either make a profit or quit the business.

All this does not mean that a good cost system is not of value to the executive in this kind of business. If anything, an accurate knowledge of costs is of even more importance. Unless he knows what his goods are costing him and how those costs are accumulated, he is in no position to study the causes of the several items of cost and in this way learn in what direction he should bend his efforts to reduce them. The closer the margin between the cost price and the selling price, the more necessary for control purposes are detailed costs of production.

THE MONOPOLY TYPE OF BUSINESS

There is still another type of business which has not yet been mentioned and which lies at the opposite end of the scale from the one just discussed, the business which is a monopoly or a semi-monopoly. Here the cost of production plays only an indirect part in the setting of selling prices. In such an industry the selling price is usually set at a figure which will give the largest volume of sales measured in terms of money. This often means, of course, that the selling price per unit will be relatively low in order to increase the volume and thus to increase the returns. Some idea of the

cost of production must be had before the selling price can be set but an approximation is usually all that is needed. As in the case before, this does not mean that cost records are valueless. They still have an important part to play in guiding the executive in his efforts to keep costs down.

The reader will probably have noted that the emphasis has been laid so far in connection with use of cost figures for setting prices on the control which the executive may exercise through the knowledge gained from them. That is really the heart of the value of cost statistics to the executive. They are or should be an instrument of control in his hands to aid him in directing his business in such a way as to bring the greatest possible returns to those who take part in it. It should not be inferred that "control" is used as a synonym for oppression of the workers.

The wise manager knows that such practices will simply kick back at him in the long run and that the more generous he can be to his employees within reason, the better off his business will be in the long run. It is poor kindness as well as poor judgment to pay wages so high that the business will be ruined and all employees thrown permanently out of employment when a slight or temporary reduction in the wage scale will permit the business to continue. Control implies the exercise of wise judgment to meet the needs of the particular situation.

Importance of Controlling Inventory

One of the hardest elements in almost any manufacturing concern to control is the inventory. From the viewpoint of the control in production, we have our material records or balance cards as they are often called. The same cards have a part to play in the cost records of material as will be explained in a later article. But it is not sufficient to have records of quantities of material only, it is also necessary to have a record of their value. To ascertain the real value of the materials actually on hand in the storeroom has always been a bugbear of every manager. Usually this has been accomplished in the past by taking a physical inventory from time to time but, as every one who has had experience with physical inventories knows, the best results are far from satisfactory and the poorest are worse than useless. An adequate cost system will provide a means for recording the receipt and issue of material so that the balance remaining in the storeroom may be found at any time.

It should not be forgotten that if the problem is complex and difficult for material purchased outside the company it is doubly so for material made inside the factory unless there is a good cost system. The only way to find the cost price of material so made and stored until it is needed for the final product is by means of the cost records.

The assistance which a good cost system can render a business in connection with its inventories does not stop here, however. It must be remembered that the materials in the storeroom awaiting use or in the stockroom awaiting shipment are only a part of the entire inventory. There are all the goods in process out in the factory to be thought of also. To take a physical inventory of all such goods is even more of a task and less satisfactory than the same kind of inventory for materials in the storeroom. A good cost system will provide the figures wanted at the end of each month or whenever they are needed on very short notice. The method will be fully explained in the later articles.

With the inventories before him during the first week or ten days of each month, the executive is in a position to make decisions with definite knowledge. What is more, he can have a balance sheet ready to present to his bankers and so be in a position to establish the standing of his concern with them in a way which is quite impossible without such aid. It is of vital importance for the factory executive to appreciate the importance of dollars and cents records of material. Accustomed as he is to thinking primarily in terms of quantities, he sometimes forgets that quantities represent money which the company must provide in some manner if it wishes to continue in business.

There are certain incidental advantages to be gained from this knowledge of the inventories. Accumulations of obsolete and useless material may be detected before it is too late to deal properly with them. The detection of losses and thefts of material is also greatly facilitated if adequate cost records are kept. When the material inventories are large, the item of insurance premiums is often a considerable one and the amount of "effective" insurance can be regulated only if inventories are accurately and promptly maintained. Practical experience with particular instances will show other ways in which inventory information is of value in the business.

A good cost system provides a means for measuring the worth to the company of its equipment. The question may arise as to whether or not it is desirable to change one machine for another, to modify a process in some way or to install additional equipment. It not infrequently happens that the answer to such a question is in the affirmative from the engineering point of view. Production quite possibly may be increased and even improved in quality. If, however, normal production is not sufficient to keep that equipment busy all or most of the time, the burden charge for its use may so increase the cost of turning out the product as to render it undesirable to make the change. A satisfactory cost system will give the cost of the present operation and will provide a basis for calculation of the cost of the proposed method and make possible a comparison on a commensurable basis.

Cost Records Point Out Unprofitable Lines

Another aid which the cost records may furnish is information about unprofitable lines. It not infrequently happens that a few principal lines of goods provide all the profits for the company and serve to make up the losses on other lines. With the knowledge of the relative value to the business of the different lines, the manager is in a position to decide what to do. Often this means simply cutting out certain lines altogether. Sometimes it results in combining the best qualities of several lines or sizes and replacing several by a new line. On other occasons it may prove necessary to carry a full line in order to meet competition, and hence be impossible to cut out any. In such a case, the information is just as valuable, for it enables the manager to guide his sales in such a way as to reduce the unprofitable business to a minimum or to insist that all unprofitable orders shall be accompanied by a certain amount of the profit making variety. Such control is absolutely impossible if it is not possible to obtain detailed and accurate costs of production on short notice.

Perhaps the most important way in which a cost

system can serve the executive has been left to the last. The problem of expenses is always one which bothers the manager unless he has adequate means for recording expenditures. If he develops a system he is then in a position to control them. In a continuous process industry, turning out a single line of product the costs of production are not likely to fluctuate violently. Test runs, if properly administered, will frequently give all the needed information in regard to the cost of the product. But even so, the manager cannot afford to be without continuous and definite knowledge of what the various departments are costing him to operate; in other words, his expenses.

One of the best instruments for the control of an entire business is a budget or schedule of prospective expenses. The budget enables them to plan for the future in a way which is quite impossible without it. The budget schedule is only one-half of this means of control, the other half being the record of what the expenses actually are as they take place. They are like two halves of a pair of scissors, neither side will cut well without the other. With such records in hand, the executive is in a position to measure the efficiency of his various departments, to take steps to check unwarranted increases in expenses, and to anticipate difficulties before they come in such a way as either to prevent them or to be ready for them.

CONCLUSION

The brief space available has permitted the outlining of only a few of the possible uses of cost accounts and records. Perhaps enough has been said, however, to give some idea of their variety and as the reader thinks over the conditions in his own factory he will undoubtedly recall many other possibilities.

The next task which lies before us is to consider what are the elements which go to make up manufacturing costs and this will be done in the following article.

Standards for Portable Electric Drills

What are believed to be the first standards for portable electric drills have been adopted by the Electric Power Club. These rules are the nucleus of a complete group of electric tool standards, and include the test requirements of motors, the performance specifications for drilling, standard sizes of drills and the information that should be given on electric drill name plates.

As electric drills are now widely employed as tools of production, as well as for maintenance work, the users of these tools have felt for some time that they should be standardized. To meet this need, the electric tool section of the Electric Power Club, which comprises the representative portable electric drill manufacturers of the country, has undertaken the standardization work.

The following is the report of the Electric Tool Section as it was adopted by the club:

(1) Definition: A portable electric drill is defined as a compact, semi-enclosed electric motor in combination with mechanical features so designed and constructed as to be applicable for drilling or reaming in wood or metal, more or less intermittently. Adopted Standard.

(2) Voltage ratings:

(a) Standard voltages for d.c. electric tool motors shall be 115, 230 and 550 volts. Adopted Standard.

(b) Standard voltages for universal electric tool motors shall be 115 and 230 volts. Recommended Practice.

(c) Standard voltages for polyphase a.c. tool motors shall be 110, 220 and 440 volts. Adopted Standard.

(3) Frequencies:

(a) Standard frequencies for polyphase a.c. tool motors shall be 60 cycles. Adopted Standard.

(b) Electric tools equipped with a universal motor shall not be guaranteed for operation on frequencies in excess of 60 cycles. Adopted Standard.

(4) Allowable variation from rated voltage: All motors shall operate successfully at normal rated load at any voltage of not more than 5 per cent above or below the name plate rating, but not necessarily in accordance with the standards of performance established for operation at normal rating. Adopted Standard.

(5) Performance specifications: The minimum drilling requirements of portable electric drills shall be based on the drilling of holes in 20-30 carbon steel with carbon steel twist drills of the full rated capacity of the electric drill, at a cutting speed of approximately 50 ft. per minute and at the following minimum rate of feed per minute for the various sizes of drills:

Twist Drill Diameter Inches	Drilling Depth Per Minute Inches	Twist Drill Diameter Inches	Drilling Depth Per Minute Inches
3/16	1 5/8	7/8	7/8
1/4	1 1/2	29/32	7/8
5/16	1 3/8	1	13/16
3/8	1 5/16	1 1/4	11/16
1/2	1 1/8	1 1/2	5/8
9/16	1 1/16	1 3/4	9/16
5/8	1 1/16	2	1/2
3/4	15/16		

Recommended Practice.

(6) Temperature rise:

Temperature rise in degrees centigrade when operating under normal conditions as specified on the name plate.

Class of insulation	A
Load, per cent of rated capacity	100
Time rating	Intermittent
1. Core and windings	
Fully enclosed motors.	55 deg.
All other types.	50 deg.
2. Commutators	
a. If Class A insulation is employed in the commutator, or is adjacent thereto and its life would be affected by the heat from the commutator.	65 deg
b. In all other cases.	85 deg.
3. Bare copper windings	60 deg.
3A. Bare copper windings, enclosed motors. Provided the thermometer is applied directly to the surface of the bare copper winding.	65 deg.
4. Mechanical parts. †Temperature rise of all mechanical parts not in contact with insulation may be such as will not be injurious in any respect.	†

Adopted Standard.
Maximum Limits.

For descriptive specification covering classes of insulation, see Reference Number 5001.

All temperature measurements by thermometer method. See Reference No. 5301.

All temperature rises are based on an ambient temperature of 40° C. See Reference Number 5002. General guarantees do not apply, and deterioration of insulation may be expected, if this ambient temperature is exceeded in regular operation.

For descriptive specifications covering temperature ratings see Reference Number 5303.

(7) Name-plate marking: The following minimum amount of information shall be given on all name plates:

(a) Manufacture, design of type and frame size.
(b) Horsepower output.
(c) R.p.m. at rated load.
(d) Frequency if a.c.
(e) Number of phases if a.c.
(f) Voltage.
(g) Rated load amperes.
(h) Time rating.
(i) Serial number.
(j) Drilling capacity or reaming capacity for a drill.
(k) Blank space for customer's shop number.

Recommended Practice.

(8) Standard sizes: The standard ratings for portable electric drills shall be as follows:

Universal Drills—Single Speed

Chuck Division Inches: 3/16, 1/4, 5/16, 3/8, 1/2
Morse Taper Socket Division Inches: 9/16, 7/8, 1 1/4

Universal Drills—Two Speed

Chuck Division Inches: 1/2
Morse Taper Socket Division Inches: 9/16, 7/8

Direct Current Drills—Single Speed

Chuck Division Inches: 3/8, 1/2
Morse Taper Socket Division Inches: 9/16, 7/8, 1 1/4, 1 3/4

Direct Current Drills—Two Speed

Chuck Division Inches: 1/2
Morse Taper Socket Division Inches: 9/16, 7/8

Polyphase—60 Cycle—Single Speed Drills

Chuck Division Inches: 3/8, 1/2
Morse Taper Socket Division Inches: 9/16, 7/8, 1 1/4, 1 3/4

Polyphase—60 Cycle—Two Speed Drills

Chuck Division Inches.: 1/2
Morse Taper Socket Division Inches.: 9/16, 7/8

Direct Current Reamers

Morse Taper Socket Division, Inches

11/16 (with No. 2 socket) 15/16 (with No. 4 socket)
13/16 (with No. 3 socket) 1 1/16 (with No. 4 socket)

Polyphase Reamers—60 Cycles

With Morse Taper Sockets, Inches

11/16 (with No. 2 socket) 15/16 (with No. 4 socket)
13/16 (with No. 3 socket) 1 1/16 (with No. 4 socket)

Adopted Standard.

(9) Hydro-Electric Power Commission, Toronto, Ontario. In December, 1921, eight member companies submitted samples to the above for test and approval. About a month and a half or two months ago, the Secretary of the Power Club inquired concerning the outcome of this test and what treatment was accorded the various companies who had submitted machines. All tests have not been concluded, consequently no definite information is available at any time for the benefit of other sections interested in the outcome of this test.

Consumption of Metal Products in Russia Before the War

By R. Poliakoff

The following table, which may be of interest to American readers, has been compiled from official Russian sources and gives an idea of the potential volume of the Russian market in metal products. The figures are for the year 1912. All data of the first three columns are in millions of dollars.

POTENTIAL RUSSIAN MARKET FOR METAL PRODUCTS

Name of Article	Produced in Russia	Imported	Capacity of Market	Loss Per Cent
	—Millions of Dollars—			
1. Agricultural machinery	26	31.5	57.5	12
2. Railroad cars	20.5	0.5	21	26
3. Locomotives	10	0.5	10.5	..
4. Merchant vessels	8.6	1.6	10.2	5
5. Electric machines and apparatus	8.4	4.5	12.9	51
6. Sewing machines	7.5	4.0	11.5	..
7. Gas and oil engines	5.6	6.0	11.6	27
8. Steam boilers	4.8	1.3	6.1	65
9. Pumps	2.6	3.6	6.2	19
10. Textile machinery	2.25	0.75	3.0	31
11. Metal working machines	1.4			60
(Machine Tools)		6.5	8.5	
Woodworking machines	0.6			79
12. Bicycles	0.85	1.45	2.3	66
12. Automobiles and motorcycles	0.6	7.3	7.9	58
14. Aeroplanes	0.15	0.15	0.30	40
15. Steam engines	0.65	2.25	2.90	49
16. Printing machines	....	0.85	0.85	..
17. Typewriters	....	0.60	0.60	..

The figures of the fourth column show the loss in per cent of the yearly Russian output due to the decrease of territory on account of the separation of Poland, Lituania, Finland and the Baltic Provinces. With regard to the figures of this column, one has, however, to take also into account that the actual loss of output, as shown by them, would, under normal economic conditions, be less, as a considerable part of the equipment of the enterprises in the lost provinces was evacuated during the war into the interior of Russia and could be used for Russian domestic production, normal conditions.

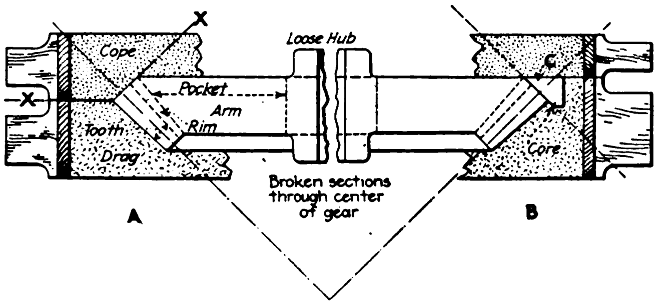
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Better Way to Mold Gear Wheel Patterns

By M. E. Duggan

In the broken section shown at *A* in the accompanying illustration appears the conventional method for molding a gear wheel in green sand, with the parting along the lines *XX*. This method is often the cause of a great deal of lost time in the fitting shop by reason of the necessity for correcting defects in the casting that result from "shifting" or mismatching of the cope flask. The space between the arms is molded in green sand and this sand is lifted with the cope. The cope hub is loosely fitted to the pattern. A foundry that is fully equipped with the necessary rigging to handle this class of work can do it very nicely, although few general jobbing foundries are so equipped.



TWO WAYS OF MOLDING A GEAR PATTERN

A few of the details that make trouble for the molder in the average foundry are: The shifting of the cope flask; the rising, or rocking, of a poorly fitting cope; or a "crush" in the setting thereof. Again, it sometimes happens that the pattern maker is not quite sure how the gear is going to be molded and in order to play safe he will make the sides of the arms parallel, thus making the lifting of the green sand between them a very difficult task for the molder. When a "rise" or "crush" or "shift" has occurred, the resulting casting will have a fin along the cope edge of the teeth that makes a lot of extra work in the cleaning room.

When the molder finds that the sides of the arms are too straight to insure an easy and clean lift he will convert that part of the pattern into a corebox and make a dry sand core in each of the pockets between the arms, marking each core and space into which it fits so that he may be sure to return each core to its respective place and avoid the trouble that would otherwise surely follow by reason of the pockets not being all of exactly the same size and shape. At *B* in the illustration is shown the pattern made and molded in another and better way, as none of the above-mentioned troubles will affect the production of a clean true casting with but a minimum of chipping required along the edges of the teeth. The pattern is made with a ring coreprint, as at *C*, and the parting is in a straight line along the edges of the arms. The whole pattern is molded in the drag with a "flat-back" cope except for the loose hub.

This method of molding the arms should be made with plenty of draft, thus simplifying the making of the cores within the pockets. These cores are suspended from the cope and lifted with it. The corebox for the ring core is made ⅛ of the circumference of the pattern. The pattern is laid on the molding floor with the parting face down and molded in the usual way. It is then "rolled over," the cope flask put in position, the core suspension wires securely fastened to cross-bars on top of the cope flask, the molding of the cope finished and the cope lifted off. The pattern is then drawn, the ring cores set and the cope returned to place ready for pouring.

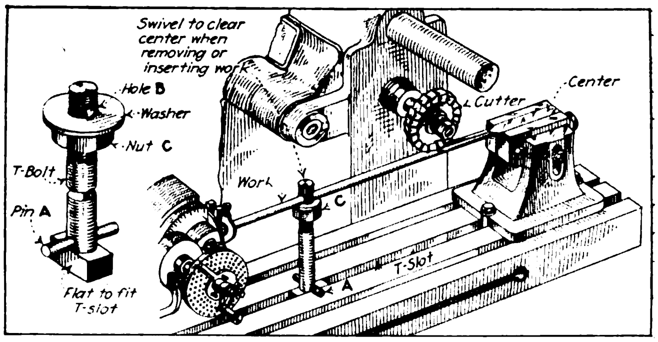
Work Support for the Milling Machine

By Harry Moore

Some time ago we had an ordinary job of milling, that of milling two opposite flats on the ends of some ¼-in. rods, that gave us a lot of trouble because of the necessity for continually adjusting the supporting jack to stop the chatter. Our results were very unsatisfactory.

The operator finally made the device here shown, which consists of an ordinary T-head bolt with the head ground away to fit the narrow part of the slot in the table and a cross pin to rest upon the table surface. A hole was drilled at right angles through the upper end of the bolt to fit the rods and a nut and washer placed upon the threads to screw up against the rods from the under side.

As the hole at the top is carefully located at the correct distance from the supporting pin there is no need for further adjustment and the nut can be screwed up to hold the rod tightly. At the same time as the head of the bolt fits the narrow part of the T-slot only, the whole thing may be tilted to replace the work. It required but a few minutes' time to make the device and the results secured justified this expenditure by the saving effected on even a very few of the rods.

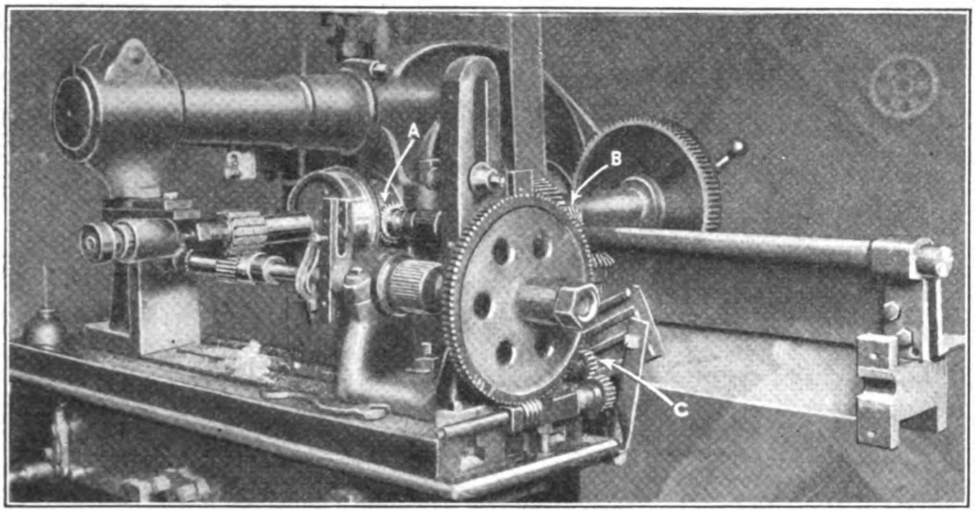


SPECIAL SUPPORT FOR SLENDER WORK

An Improvised Gear Hobbing Machine That Paid For Itself

By Robert Brainard

The machine described in this article has paid for itself many times over and is still in use in the shops of the Joslyn Mfg. Co., Chicago, Ill. Having a few gears to cut occasionally and an old milling machine that had seen its best days, the foreman decided to kill two birds with one stone. He cut off the lower part of the arm bracket, which carries the bearing for the outer end of the arbor, and attached a flat plate to it by means of a couple of screws. To a similar plate was attached a screw center. The two plates were then bolted together with two cap screws. Next a shank was turned to fit the taper in the machine spindle and the large end of the shank was formed to act as a socket for a ball and socket joint.



AN IMPROVISED GEAR HOBBING MACHINE

After this had been put into the spindle, an internal ring gear was cut and attached to a round plate with a hub that was threaded to fit the thread on the spindle nose. The plate had a bevel gear cut on the back of it to mesh with the bevel pinion *A*. A cutter arbor was attached to a gear that fitted into the internal gear, as shown, the end of the arbor projecting through the gear with a ball turned on the end to fit into the socket in the spindle. Then the cutter was put on and the outer end of the arbor supported by the screw center. The two gears were of the same pitch and the same number of teeth, but a little extra clearance was allowed when the gears were cut, which allowed the arbor to be swung around at an angle to correspond with the angle of the teeth of the hob while at the same time forming a positive drive. A curved slot was cut in the upper plate for the cap screw and graduations were scratched on the top of the plate to indicate degrees. The work was held as shown.

Bevel pinion *A* drives a long shaft carrying a bevel gear *B* that meshes with another gear on a short shaft and thus drives a train of gearing that controls the work-arbor. Gear *C* is an intermediate gear that can be moved on the block on which it is located so as to accomodate the various change gears that have to be used to secure the correct ratio between the hob and the work. As there is no backlash between the worm and wormwheel, it is a comparatively simple matter to turn out first-class work with this outfit.

Cams for Brown & Sharpe Automatic Screw Machines—Discussion

By S. N. Bacon

Under the above title on page 460, Vol. 57 of the *American Machinist,* Stephen McEvoy makes a very good comparison of single and double layout methods. There is another method of double layouts which has caused much misunderstanding, namely; the forming, drilling and cutting off of two parts, instead of one. Many engineers and superintendents, having only a general knowledge of screw machine practice, are of the opinion that this method will result in increased production, but designers of cams, who have analyzed the required feeds and speeds generally agree that the double system is not more productive than the single and is less efficient. It is true that a double cut off tool may be used and the second piece partly cut off while the first is being separated from the bar and that in the drilling, reaming, etc., of both parts, time is saved in indexing the turret. In the majority of cases, when machining one piece at a time, the turret operations (including indexing) are performed during a forming operation. Another point to bear in mind in forming two parts at the same time is the double width of the form tool. Such a tool should be advanced but one-half the amount per revolution of the spindle than would be the case were the single tool used, therefore there would be no saving in time and a more expensive tool would be required.

Double jobs also give trouble in keeping the parts to length, as the length of the first part cut off the bar is gaged between the cutoff tool and the stop in the turret, while the length of the second piece is gaged between the two cutoff tools. As there are exceptions to every rule so will there be a few cases where the double cross-slide tooling or the double cams and turret tools can be used advantageously.

Lubricants for the Shop—Discussion

By Leslie Tourtellotte

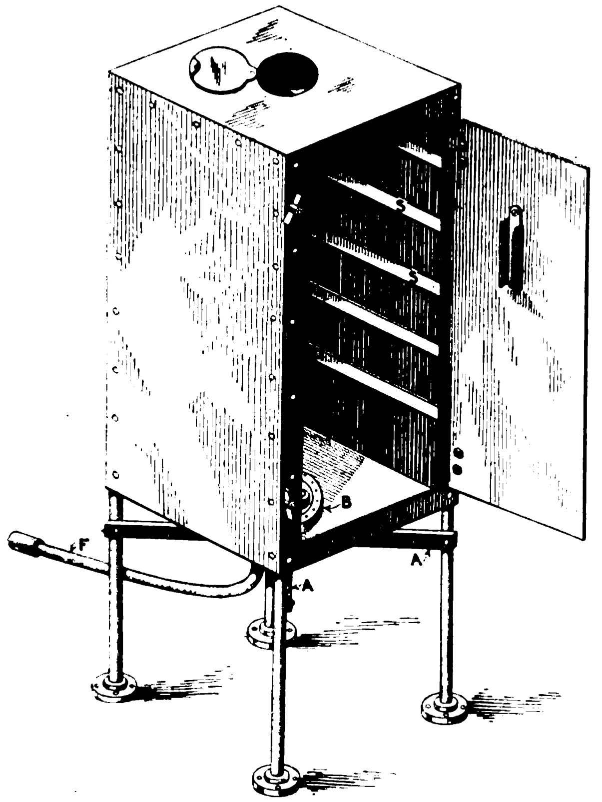
Referring to an article under the above title by H. R. Smith on page 462, Vol. 57 of the *American Machinist,* may say that I have used lard oil and turpentine for a long time, but one time I was cutting a thread and it would tear in spite of anything I could do until the old mechanic said to me "Why don't you put some white lead in your oil?" So I used lard oil, turpentine and white lead. It worked fine; so now we use it nearly all the time. The white lead will settle to the bottom of the can but with a little stirring once in a while it will be all right. It is applied with a brush and should be just thick enough so it will stick on the work without running off too readily.

For a lathe center lubricant we use machine oil and white lead with very good results. It is mixed just about as thick as paste and a little will go a long way.

A Simple Enameling Bake Oven

By Donald A. Hampson

The drawing shows a small oven that may be constructed in any shop at a cost of a few dollars, mostly spent for labor. It will answer its purpose as well as a much more expensive outfit and, moreover, it is portable and may be taken from department to department, if the work so requires. It may also be carried outside of the shop for storage purposes when not being used. As an instance of the desirability of a portable outfit, one shop's experience shows that such an oven was used for two hours on July 10 for baking twenty-five auto horn cases, four hours on July 30 in one of the



OVEN FOR BAKING ENAMELED WORK

private experimental rooms on some radio models, then not again until Sept. 5 when it was used on the floor of the main machine shop for baking the finish on a copying press that had been repaired for a nearby office.

The oven is constructed of half-inch pipe and 24-gage galvanized sheets together with a few pieces of hardware. The four "sides" are alike and are screwed to the pipe standards. The top has two edges turned down and stove-bolted to the sides proper; the opening of the vent may be adjusted by means of a swing cover. The hinged door on the front laps a half inch over the opening cut in the front sheet and is held in a closed position by two metal buttons.

Two cross pieces, *A* and *A*, are screwed to the legs some distance below the sheets to form a support for the burner *B* which is merely the burner from a discarded gas stove. An eight-inch burner serves very nicely for an oven 24 x 24 x 42 in. If the ovens were set up permanently, it would be connected with the gas supply by iron pipe, but in a majority of cases the familiar soft connection *F* is all that is needed and is perfectly satisfactory. To avoid soot and smoke from city gas, it will undoubtedly be necessary to introduce more air into the burner to get a clean bunsen flame and, once adjusted, it will not have to be touched again and the only attention in lighting up will be to regulate the cock for the size of flame desired.

A thermometer will be observed hanging on the inside of the oven door. This location is not ideal but it is convenient and as good as any, for no one location in such an oven reads true for all others. For baking the class of work intended, an exact temperature is not necessary, so that a thermometer reading of say 275 deg. may be assumed as giving a fair baking temperature for a given class of work in all parts. Readings can be taken and the flame adjusted accordingly, by opening the door for a moment. Various ways of supporting the work pieces will suggest themselves in each shop. In this oven, strips *S*, *S* are stove-bolted to the side sheets and upon the strips the rods for hanging the work are laid.

Knurling Bushings in an Automatic Screw Machine

By S. N. Bacon

An interesting problem in automatic screw machine work is shown in Fig. 1. The collar is made from $\frac{7}{8}$-in. brass rod and is counterbored in one end and countersunk and knurled in the other. It would be a simple matter to countersink and knurl from the turret, then counterbore the opposite end in a hand screw machine but as this would add considerably to the production cost of the piece the machine was tooled up, as shown in Fig. 2, and completed in one setting in a No. 2 Brown & Sharpe automatic screw machine.

After the work has been drilled, reamed and counterbored it is countersunk at *A* by use of the turret swing

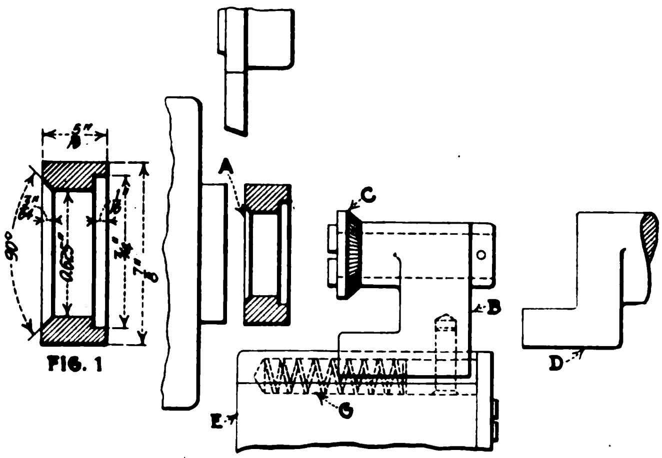


FIG. 1—THE BUSHING TO BE KNURLED. FIG. 2—ARRANGEMENT OF KNURLING TOOL AND HOLDER

or recessing tool. The knurl holder *B* carrying knurl *C* is operated longitudinally by the pusher *D* mounted in the turret. The knurl holder *B* is slidably mounted on the special tool post *E* and is returned, when the turret has withdrawn, by the compression spring. The base of knurl holder *B* is fitted to toolpost *E* with a dovetail slide of sufficient width to prevent chatter.

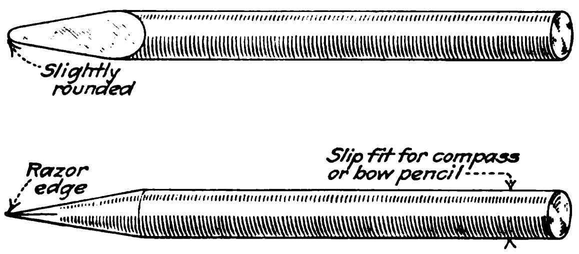
In operation, the front cross-slide can advance the knurling tool transversely and causes it to dwell, while the lead cam advances it longitudinally, into the hole and, in turn, causes it to dwell while the cross-slide cam advances it for a second time, feeding it into the work.

Making Paper Models in the Drafting Room

By Hugo F. Pusep

Frequently the tool designer needs a paper model of the piece for which he is to design blanking and drawing dies or other tools. Such a model is of great help in calculating the correct proportions for the design.

The model is laid out on thick drawing paper to the dimension taken from the part print and, when cut out along the pencil lines, becomes an accurate duplicate of the part to be made. Straight lines are easily cut by laying a scale or straightedge on the paper and following it with a sharp penknife, but the radii present



POINTS FOR CUTTING PAPER MODELS

greater difficulties. Some draftsmen use scissors for cutting around the curves, but this is an inaccurate and unsatisfactory procedure.

To make a tool suitable for this purpose, take a piece of drill rod of the same diameter as the compass lead and file or grind it to a round chisel point, as shown in the sketch. Harden this point to glass hardness and then hone it to a real razor edge.

The piece or drill rod may now be secured in the bow-pencil or compasses and, with the needle point on the center of the radius, it needs only a few passes of the sharp point over the curve to cut clear through the paper. The radii of the model should be cut first and joined with the straight lines.

Another valuable kink is to place a piece of thick blotting paper under the model to be cut. The blotting paper has the peculiar quality of resisting sharp pointed instruments, yet allowing them to retain their keenness of edge, thus protecting the drawing board and any other drawing that may be under the model while the cutting operation is carried on.

Getting Long Service from Round Broaches in Cast Iron

By George E. Hodges

The writer always gains a few hundred pieces from round broaches on cast iron work by having the new broach oversize and using a lubricant. This would seem odd to those who have set opinions about lubricating tools cutting cast iron but the writer has found that it pays. The cast iron hole closes in about 0.0015 in. on a one inch hole when lubricant is used.

After the broach is used until it cuts small, the lubricant is discontinued, and the broach is good for as many pieces as though it was made to size in the first place. The only disadvantage of this plan is the difference of finish, the one obtained with lubricant being far superior. Soluble oil, diluted as for broaching steel is the lubricant used.

Drafting Room Kinks

By G. A. Luers

A double pen, consisting of two pen points placed in one holder with the points overlapping, as shown in Fig. 1, is a time and effort saving device for work with

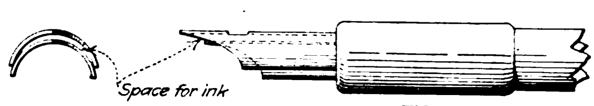


FIG. 1

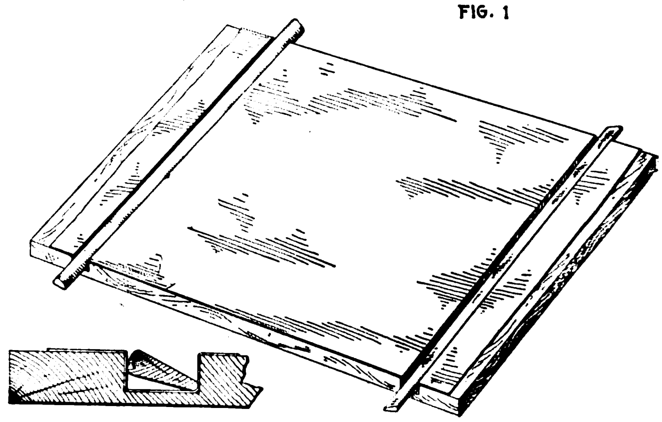


FIG. 2

FIG. 1—A PEN THAT HOLDS CONSIDERABLE INK
FIG. 2—HOLDING PAPER ON THE DRAWING BOARD

India ink. The filling of a pen point with a quill dipped in ink is an annoying loss of time. A fountain pen would be ideal but it cannot be used with India ink. The double pen requires only an occasional filling, serving somewhat as a fountain pen. In lettering work when the body and arms are in position, the constant replenishing of ink is a waste of time. The double pen method is more economical and has been found to be of considerable advantage.

A feature in drawing and sketching, which is undesirable is that of thumb tacking the paper to a sketch board. The paper is continuously shrinking and expanding and necessitates shifting the tacks to have the paper taut. To avoid this, a sketch board made with a groove and a wedging slat at each end, as shown in Fig. 2, has proved of much advantage in placing the paper. With this arrangement no tacks or tack pullers are required and the corners of the paper are not mutilated or corners of the board so perforated that they fail to hold tacks after a period of use.

The paper is made taut by pushing one of the slats into the groove while the other is in place. For thin sketch boards, where the depth of groove is limited, brass strips can be advantageously used in place of wood slats. In either case the fastenings will be below the surface of the board and the T-square will slide freely over them.

Soliloquies of Old Mac

To get a firm grip on a piece of thin tubing without flattening it or leaving the marks of the vise jaws on it, fold a strip of fine abrasive cloth so the abrasive is on the outside. Make a loop of the cloth about the tube and grip the ends in the vise as close to the tube as possible.

It is surprising how tightly the tube may be held in this manner.

Bolt Head and Nut Standards

The National Screw Thread Commission is at work on the problem of standardizing bolts and nuts so as to reduce the number of wrenches now necessary. Recent meetings at Washington, D. C., and Springfield, Vt., brought out much interesting discussion. While it is desirable to have both bolt heads and nuts of the same dimension, the question of securing punched nuts of as small a diameter as is perfectly safe for the head was brought up by bolt makers. This is particularly true when it comes to considering the proposition to adopt the S.A.E. sizes for all work. The following recommendations were submitted:

1. Bolt Heads and Nuts.

(a) Bolt heads, nuts, and capscrews shall conform in short diameter and thickness to the U. S. Standard for coarse threads and to the S.A.E. Standard for fine threads, modified as shown in columns 3 and 4, Table I, N.S.T.C. No. 39.

(b) The maximum width across the flats, short diameter, shall be basic size and this maximum width shall apply to finished, semi-finished, and rough hexagonal and square bolt heads and nuts.

(c) Tolerances on all bolt heads, nuts and capscrews shall be *minus* and in amount as follows:

Bolt Size	Tolerance
1/4 in. to 1/2 in.	0.005 in.
9/16 in. to 1 in.	0.008 in.
1-1/8 in. to 2 in.	0.010 in.
2-1/4 in. to 3 in.	0.012 in.

The allowances and tolerances on openings of wrenches shall be *plus* and in amount as follows:

Bolt Size	Allowance	Tolerance
1/4 in. to 1 in.	0.002 in.	0.005 in.
1-1/8 in. to 2 in.	0.004 in.	0.008 in.
2-1/4 in. to 3 in.	0.006 in.	0.010 in.

2. Machine Screw Heads.

(a) Standard designs of machine screw heads shall be limited to the following:

1. Round head
2. Flat head countersunk (82 deg.)
3. Oval countersunk (82 deg.)
4. Flat fillister head
5. Round fillister head

(b) The length of the screw shall be defined as the distance from the largest diameter of the bearing surface to the extreme end.

(c) The form and size of head shall conform to forms and dimensions derived from formulas of A.S.M.E except for size of slot which shall be as follows:

Size of Screw	Width of Slot	Depth of Slot
0 to 2	0.024 in.	0.020 in.
3 to 6	0.030 in.	0.040 in.
8	0.042 in.	0.050 in.
10 to 12	0.051 in.	0.060 in.

With reference to square and hex. screw stock it was suggested that the effort of the Commission should be to assist in establishing the practice of having all screw stock run from basic to below basic, instead of basic plus or minus.

It is to be understood that the tolerances and allowances proposed for wrenches are to apply to open end wrenches only, socket wrenches are to be considered separately. The second suggestion would eliminate wrench sizes but requires different stock for bolts and nuts to be finished. George S. Case, of the Lamson & Sessions Co., does not feel that the A.S.M.E. sizes will cover all cases and proposed three series of nut dimensions. The first makes the nut the size of the bolt head—the second the size of the next larger bolt head and the third, the size of a bolt head two sizes larger. Mr. Case suggested the following dimensions to 1 in. Above that he suggests that the width across the flats be 1½ times the bolt diameter for both bolt heads and nuts. His proposed sizes are:

	Width Across Flats	
Size	Bolt Heads	Nuts
1/4	3/8	7/16
5/16	7/16	9/16
3/8	9/16	5/8
7/16	5/8	3/4
1/2	3/4	13/16
9/16	13/16	7/8
5/8	7/8	1
3/4	1-1/8	1-1/8
7/8	1-1/4	1-1/4
1	1-1/2	1-1/2

Diameter	Across Flats	Thickness
1/4	3/8	3/16
5/16	7/16	7/32
3/8	9/16	9/32
7/16	5/8	5/16
1/2	3/4	3/8
9/16	13/16	13/32
5/8	7/8	7/16
3/4	1 or 1-1/8	9/16
7/8	1-1/8 or 1-1/4	5/8
1	1-1/4 or 1-1/2	3/4

The makers of wood screws have eliminated many sizes and have adopted the same sizes of wire used in making machine screws.

Attitude of Secretary Hoover on the Metric System

While believing that the metric system can be applied to good purposes in the scientific field, there is reason to believe that Secretary of Commerce Hoover has in no way altered the opinion he has expressed on several occasions since assuming his portfolio. It is his opinion, that there is nothing to justify its general application at this stage of the country's development.

The period when productivity is important would be no time "to warp the brains of the country's mechanics" in their efforts to acquire the metric system, Mr. Hoover thinks. He thinks much of the propaganda for the metric system comes from a single indefatigable enthusiast.

America's Ability in Competition

The United States cannot hope to compete with the low-cost countries in the manufacture of the simpler forms of machinery which are not made on a large scale. There is increasing evidence, however, that this country can compete in any market with machinery which is made in large quantities and with such articles as machine tools, typewriters and locomotives. These are developments of American ingenuity and the actual control of their market will probably remain with this country.

The two great elements which will favor American industries are the use of labor saving machinery and the duplication of parts. Until foreign manufactures are equipped to use of these principles, we should enjoy an agreeable advantage.

Editorial

THE AVERAGE purchasing agent gets little sympathy and sometimes deserves less than he gets. But he is not to be envied when, with a falling or rising market, he is confronted with the problem: To buy or not to buy. If he makes a mistake, his company may be confronted with the problem: "To be or not to be."

What's Wrong with the Railroad Shops?

ONE OF THE MOST important of the several things that seem to us to be at the bottom of railroad shop inefficiency is the matter of equipment. In the second article of our series, which appears on another page, we have gone into the equipment situation with care.

To the average citizen the condition of railroad rolling stock is the indicator of the financial stringency that government regulation of an unintelligent character has brought about. Delays give striking evidence of motive power troubles.

To the engineer and others familiar with the shop, however, a much clearer picture of the lack of funds is presented by the antiquated and obsolete tools that are found in the railroad repair shop. With any semblance of a modern depreciation reserve policy these tools would have been written off the books years ago. As it is they represent a liability rather than an asset.

The statements regarding equipment must of course be taken as general statements. They apply to the majority of shops we have visited but not to all. A few are much better, others much worse.

Another point that is brought out in the article is the place of the "show machine" in the railroad shop. There are not very many machine tools that are built with railroad service first in mind. Axle and wheel lathes, wheel boring machines, slotters and draw-cut shapers are essentially railroad shop tools and are shown off to the visitor with pride. Unfortunately they are not always used efficiently as is indicated in the article. The inefficiency is due partly, of course, to the fact that mass production is unknown in railroad practice. With the wide variety of locomotives in the service of each road, standardization of parts and stocking of spares is out of the question. Here would be a most fertile field for Mr. Hoover's Division of Simplified Practice.

It is a great pity that the men in the railroad shops have had to contend with such adverse conditions. Even the most ambitious and aggressive man cannot but be affected by lack of money, lack of co-operation, lack of proper tools for his job. It is not our intention to try to blame anyone for the present situation, the causes are too complex. But it is our belief that a fair statement of the case will help to speed the coming of changes that must be made if our transportation system is to meet the requirements of the boom period of business prosperity which is just getting started.

Even the One-Man Shop Has a Large Engineering Department

QUEER AS IT may seem, the owner of even the smallest shop has at his command highly skilled engineering forces. All that he has to do to command their services is to ask their immediate employer for a price on the machine he builds and for a guaranty as to its production. Then he buys the machine and the tools necessary for the job and the engineering comes along. Sometimes he gets more—his machine set up and demonstrated, and a stack of parts machined.

Does he pay for the extras? Yes, and for more too. He pays a part of what it cost the machine builder to figure on a job for his neighbor who didn't buy. More than that, he pays a part of what it cost the same builder to figure on a half dozen other jobs that he didn't get. The builder has to get paid, so he distributes such charges over all the machines he sells.

If each customer asked for the services of the engineering force of one builder and then either bought or did not buy, the charges for such services might be distributed equitably. But if each customer asks for the services of six builders and buys from only one, five must go unpaid or collect from those to whom they do sell.

There isn't a good reason why the engineering knowledge of a manufacturer of milling machines, for example, shouldn't be used for the benefit of all performing milling operations. It is expert knowledge and, by its use, the most economical solution of milling problems can be secured in the shortest time. But the man who invokes the engineering services should pay for them whether he buys equipment or not. If he paid that way, it would cost him less in the long run and he would think twice before making indiscriminate use of an article so costly as engineering.

The Future of Radio

WIRELESS TELEGRAPHY has been with us for a great number of years, as we count time in days, when new inventions sprout, grow up, blossom and bear fruit in a fraction of a life time. Though admired and respected, it was never intimate or even on friendly terms with the mass of the population.

Wireless telephony, on the other hand, has taken the popular fancy by storm. Hundreds of thousands, perhaps millions, of radio sets have been made and sold. Radio has given rise to a new industry. It would seem, therefore, that it is about time to take stock of the situation and look into the future as well as we can.

Is radio a fad or a fixture? This same question has been asked about many other industries which have sprung up within the memory of the present generation. There were the bicycle and the automobile, the telephone and the typewriter, the phonograph and the moving pictures. About some of them we are not quite sure even now, but all of them were at one time at a stage where we doubted whether the rapid progress of the new in-

dustry was evanescent or lasting. Radio presents some phases which the other industries did not have and which make a prediction even more difficult.

That wireless telegraphy and telephony, as well as other uses of radio transmission of energy, have come to stay does not admit of any doubt. What is not so certain, however, is the extent to which they will keep a hold on the masses.

The pillars which are now supporting the structure of the industry furnishing the radio sets are the broadcasting stations. Such stations are under great expense to give the entertainment they are furnishing now. They are repaid by the expansion of the industry. As soon as this expansion is checked, it will be doubtful if broadcasting will continue as at the present, and if not, it is more than doubtful whether the same number of enthusiasts can be found which we find at present.

Besides, the radio is merely a novelty to many people, a new sensation, a kind of experiment with mysterious forces. When the novelty wears off there will be many who will no longer have use for the radio sets.

At best the music which is now delivered by the radio set is an inferior kind of phonograph noise. It is doubtful whether it will ever be possible to perfect the radio apparatus to such an extent that the music transmitted by it can be compared to what we hear in the concert hall or even at home. Between the mouth of the singer and the ear of the listener there are so many joints and connections, so many forces at work, so many possibilities for disturbance, that it is not reasonable to look for the perfection of transmission which comes when the voice is brought to us merely through the vibrations of the surrounding atmosphere.

The music which comes to New York from Pittsburgh is wonderful because of the way it got there, not on account of the quality. So also are we willing to listen to lectures given at a distant point, which if delivered in our home town would put us to sleep.

For all these reasons, it seems that we may expect a considerable slacking up of the popular interest. Maybe not now, maybe not in five years, but ultimately, unless some other use is found for radio, a use which is not only interesting but instructive and educational as well. It would seem that by proper co-operation among the great companies, perhaps jointly with state or federal government, much can be done along these lines and, if it were done, the popular interest would be maintained.

Shortly, if radio is to continue to live among the masses, it must be interesting on account of what it gives, not merely on account of its mystery.

High Cost of Distribution

FORTUNATELY, the problem of distribution is receiving more attention than formerly. Even the engineers who have hitherto devoted all their energies to reducing production costs another fraction of a cent per piece are beginning to study the question seriously. In the past they have been struggling only with the smallest item of the total cost of most manufactured articles, direct labor.

A glaring example of the high charge (whether it be all "cost" must be judged by each for himself) of automobile parts happened recently in a large eastern city. The owner of a well known car of distinction, if not exclusiveness, lost a small sheet metal cover which allowed the adjustment of the brake and served to keep dirt out in regular running. At the service station of the company building his car, he was charged two dollars for a new one, plus the labor of putting it on.

It so happened that this particular car owner was also a manufacturer of sheet metal goods and himself made these particular covers for the party who supplied the axles for the car. A dollar an ounce or thereabout seemed rather high for a plain sheet metal stamping and he had his secretary look up the price at which he supplied them to the axle makers for the car.

The books showed that his price on the piece, including material, labor, overhead, and the profit which enabled him to buy this car of distinction, was just eight cents. In going to the axle maker, from there to the car maker, and back to the service station in his own city, it had increased in cost from eight cents to two dollars, or twenty-five times. And yet they say that a rolling stone gathers no moss. It would seem as though the efficiency experts might well give the harassed production man a little time for even peaceful inefficiency and turn their energies to fields which offer so much greater opportunities.

Why Make Machinery the Goat?

AN EDITORIAL in the daily press calls our attention to the fact that a college professor has proved (to his own satisfaction) that many of our modern troubles are due to machinery. Hence, the argument runs, we should cast the machinery from us as an unclean thing and get along virtuously without it. The writer of the editorial is a little less drastic in that he can see a difference between good machinery and evil machinery and would have us keep the good but throw out the bad.

Here we have what seems to be almost the last step in passing the buck. From capital to labor, from labor to capital, to the manager, to the engineer, to the government bureau it has gone, and each has found a way to pass it along. But now it has been passed to an inanimate machine and how can the machine get rid of it?

Just why men who call themselves thinkers will persist in blaming machinery for the mistakes of management is beyond our comprehension. And yet they keep right on doing it. Granted that conditions in steel plants and manufacturing centers are not ideal, is it the fault of the machinery that men have built to do the heavy work for them? We can't see that it is and we are prepared to go a step farther and say that in many cases the bad conditions are at least partly due to the lack of machinery.

Just Suppose

JUST suppose you could hitch a taximeter on your salesman that would start working merrily when the P.A. sends out word he is busy. And suppose you could send a bill to the P.A. for all the money you lost while your salesman wasted his time because the P.A. was discussing the ball game or telling of his latest motor trip. Best of all, suppose you could collect the bill.

Be great wouldn't it? Ought to be done, of course.

But, just suppose you had to pay what the other fellow's salesman's taximeter said you owed him? Perhaps we'd all be more prompt and courteous—if it cost real money not to be? Can't be done? Possibly not, but—

Just suppose.

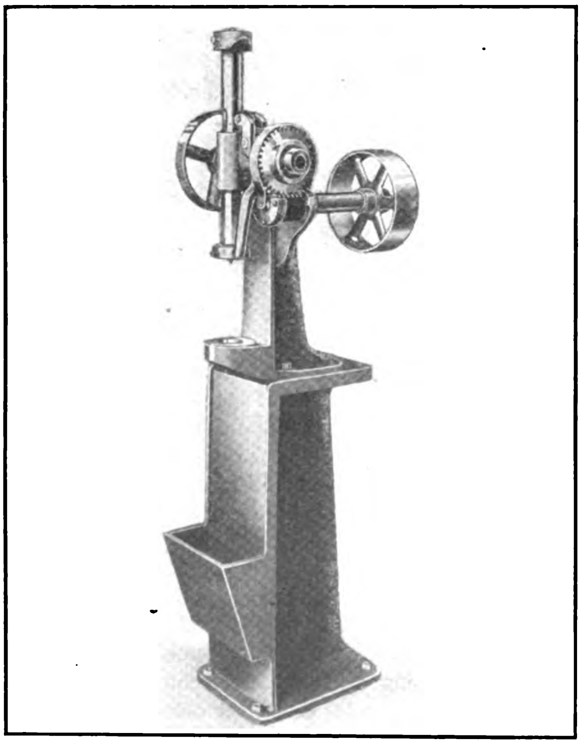
Shop Equipment News

American Broach & Machine Co. Bench Broach Press on Pedestal

A power-operated bench broach press mounted on a floor pedestal has recently been placed on the market by the American Broach & Machine Co., Ann Arbor, Mich. The machine, which is shown in the accompanying illustration, is similar to the vertical bench broach press described on page 695, Vol. 55, of *American Machinist*. It is intended especially for broaching small holes and keyways. The machine is rapid in its action, so that high production is obtainable.

The machine is operated by belt on a constant-speed pulley, and the power is transmitted through a steel worm and a bronze worm gear to the ram, which is operated by rack and pinion. The machine is fitted with an automatic stop, and the movement of the ram is controlled by a positive jaw clutch of hardened steel. The machine can also be operated by hand power, the handwheel having hollow spokes to receive a bar. A counterweight serves to raise the ram after the power has been disengaged. Approximately, 2 tons pressure can be obtained. The maximum stroke is 14 in., and work up to 6 in. in diameter can be handled. The table has a $2\frac{1}{2}$-in. hole. The driving pulley is 10 in. in diameter and has a 3-in. width of face.

The pedestal shown has an oil receptacle which can be connected to an oil pump when required. The height to the top of the work table from the floor is 36 in. The machine complete with the pedestal as shown in the illustration weighs about 315 lb. Only a small floor space is required.

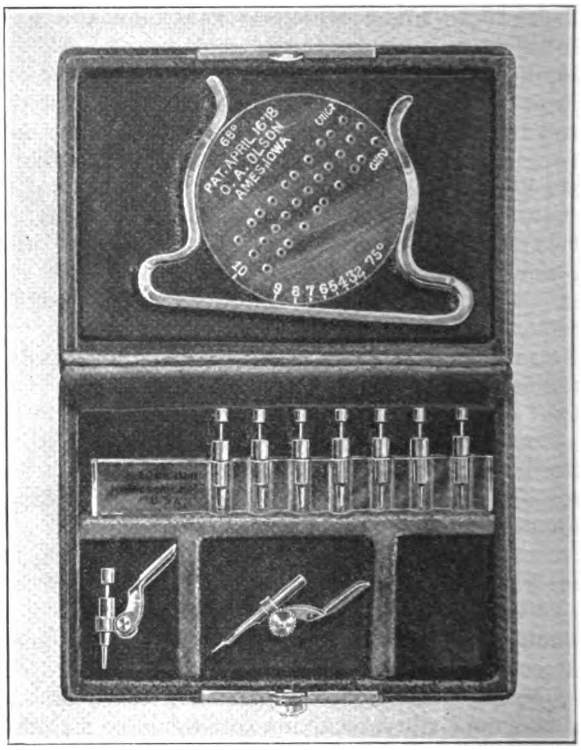


"AMERICAN" BENCH BROACH PRESS ON PEDESTAL

Bourquin "Leroy & Ames" Set for Draftsmen

Some pens and a lettering instrument for the use of draftsmen, engineers and those doing lettering and drawing work have recently been placed on the market by Edgar Bourquin, 1353 Main St., Waltham, Mass. The accompanying illustration shows set No. 100, although smaller sets including only that part of the apparatus required can be furnished.

The flap of the case that is shown raised in the illustration forms a pocket for holding the Ames lettering instrument that can be seen lying inside the cover of the case. This instrument consists of a nickel-plated steel frame holding a celluloid disk that may be rotated in it. In the disk are three parallel rows of tapered holes for drawing guide lines for lettering. The instrument is used by holding the base in contact with a T-square or straight-edge, and then pulling it alternately from right to left by a pencil placed in a hole in the disk, the position of the pencil being shifted from hole to hole after each movement across the paper.



"LEROY & AMES" NO. 100 SET FOR DRAFTSMEN

The holes in the center row are evenly spaced, while the holes in one side row are spaced so that the bodies of the letters will be two-thirds of the height, and in the other row three-fifths of the height. The numbers on the edge of the disk indicate fractions whose understood denominator is 32, so that the total height of the letter is shown by the number opposite the mark on the base.

In the case are compartments for holding the pens,

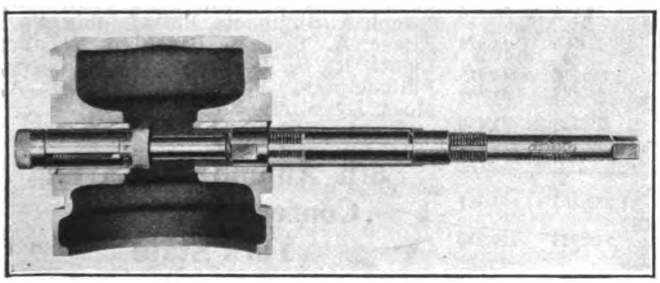
and a special celluloid holder for the Leroy tubular pens. These pens are adapted to both ruling and lettering. They are of the fountain type and are filled by means of a dropper such as ordinarily employed for ruling pens. In each tube is a cleaner that can be easily removed. The slight projection of the cleaner beyond the nose of the tube serves to constantly prime the pen. Movement imparted to the cleaner by the contact of its lower end on the paper, or by turning with the fingers from above, serves to keep the ink agitated so that it will flow, and to remove hardened particles that tend to clog up the point. The ink is retained even when the cup is full, so that it does not drop from the point when the pen is lifted. The width of the line made depends upon the width of the point, so that a range of sizes of pens is furnished. The width of line is easily controlled, as it is always the same for any one point.

The tube points are interchangeable in a swiveling socket, in which they can be locked in such a position as to make the position of the holder most convenient for the user. The same socket can also be employed for holding Gillott's crow quill pens, one of them being shown clamped in position and lying in a tray in the box. The case for the No. 100 set is 4½ x 3 x 1 in. in size, leather covered and lined with plush.

"Nu-Angle" Expansion Line Reamer

The Vedoe-Peterson Co., Norfolk Downs, Mass., has just placed on the market the "Nu-Angle" expansion line reamer for reaming piston-pin bushings. The tool is similar in construction as far as the arrangement of the blades is concerned to that described on page 162 of *American Machinist*. It has six blades placed at angles to the axis so as to minimize chatter and gouging. Regardless of the size of the reamer, it can be adjusted through a range of 0.030 in. Thus accurate control of the size of the finished hole is possible, and either standard or oversize pins can be fitted.

The tool is equipped with a pilot and an expanding sleeve, so that the two holes in the bushing will be exactly aligned. Throughout the whole reaming operation, the tool is guided and supported by the solid pilot and the expanding sleeve in one bearing while reaming the opposite bearing.

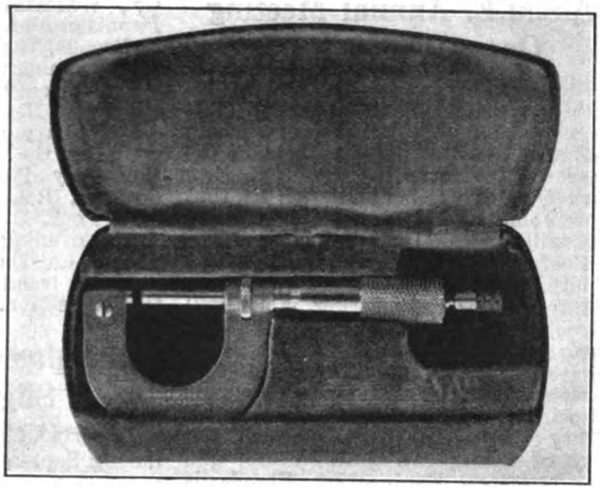


"NU-ANGLE" EXPANSION LINE REAMER

The reamer is made in nine sizes capable of reaming piston-pin bushings in practically every make of automobile. The diameter available ranges from 0.66 to 1.14 in., and the length over all from 9¾ to 12¾ in. Three reamers can be furnished to ream the piston-pin bushings employed in the great majority of automobile motors. The tools are packed in wooden boxes equipped with compartments to hold them in place.

Brown & Sharpe Pocket Micrometer Case

The accompanying illustration shows a case that fits the pocket, and that has recently been placed on the market by the Brown & Sharpe Manufacturing Co., Providence, R. I., for holding 1-in. micrometer calipers. The principal feature of the case is its shape, as it is designed to fit the pocket without taking up much room or causing a large bulge, as might occur with the ordinary case. Its use protects the micrometer from dirt and injury due to carrying in the pocket.



BROWN & SHARPE POCKET MICROMETER CASE

The case is made of metal, covered with leather and lined with plush. It is furnished in two styles, the No. 202 for the standard micrometer made by the concern, and the No. 203 for the "Rex" micrometer. The inside of the case is so shaped as to hold the micrometer securely in position and prevent it from moving in the case.

Moving Machinery as per Schedule

As is generally known, parts of the Ford works are being moved from Highland Park to the River Rouge plant and thereby hangs a tale which may well be noted, and copied. The moving isn't done in a haphazard manner but as per schedule. The time came to move a certain group of machines of the cylinder block group. The machines ran at Highland Park until the moving men backed a truck up to receive the machines, then the men put on their hats and coats, checked out and took a street car, or cars, for the River Rouge plant.

It is a long way from one plant to the other, especially by street car, and it's several miles even as the truck flies, to paraphrase an old saying. But they finally arrived and when they reported to the foreman, their machines were already in place, wires were connected and all they had to do was to put in a piece of work and throw on the current. Needless to say the men were surprised, as is everyone who hears it. But though it might seem like a miracle to most shops, it is not only possible but it actually happened. And all because the moving was planned and carried out systematically.

Incidentally it was made easier to have the machines ready to run by the time the men arrived, due to the independent motor drives with which the machines were supplied.

Some moving!

News Section

A.S.M.E. Annual Meeting Opens December 4

The annual meeting of the American Society of Mechanical Engineers, the biggest of the national engineering gatherings of 1922, will be held in the Engineering Societies Building, New York City, December 4 to 7. At that time John L. Harrington of Kansas City will succeed Dean Dexter S. Kimball of Cornell as president of the society.

A feature of the meeting, which will attract engineers, manufacturers, economists, educators and industrialists from all over the country, will be joint sessions with the American Economic Association, the American Society of Safety Engineers, the American Society of Refrigerating Engineers, and the American Engineering Standards Committee.

H. F. Loree, president of the Delaware and Hudson Railroad Co., and E. M. Herr, president of the Westinghouse Electric and Manufacturing Co., will be among the speakers at the economic forum, at which addresses also will be delivered by Dr. W. C. Mitchell of the National Bureau of Economic Research, and professor of economics at Columbia University; Prof. H. H. Seager of Columbia, president of the American Economic Association, and Dean Kimball. Mr. Herr's topic will be "The Human Problem in Industry." Prof. Mitchell will discuss "Making Money and Making Good."

Taylor Society Will Hold Three-Day Session

The Taylor Society will open its 1922 Annual Meeting in the Engineering Societies Building, 29 West 39th St., New York City, on Wednesday evening, November 22, with its annual dinner at 6 o'clock. This will be followed by the annual business meeting.

The sessions of Thursday, November 23, will be given over to a discussion of the following papers by the authors named:

The Organization and Management of a Medium-sized Plant: emphasis on manufacturing organization and management, by Percy S. Brown, Works Manager, Corona Typewriter Co., Groton, N. Y.; Statistical Compilation—some of its uses as a function of scientific management, description of a statistical department, its organization, equipment and product, and the use of the latter in managerial control, by Harry B. Horwitz, Planning Department; Harry A. Wembridge, Statistical Division; and Herman J. Hutkin, Methods Division; The Joseph & Feiss Co., Cleveland; Shaping Your Management to Meet Developing Industrial Conditions, by H. S. Person, managing director, Taylor Society, New York.

The program for November 24 is as follows: Master Budgets of Sales and Production; Case 1—The Hood Rubber Co., by W. W. Duncan, Hood Rubber Co., Watertown, Mass.; Case 2—The Dennison Manufacturing Co., by Ernest E. Brooks, The Dennison Manufacturing Co., Framingham, Mass.; Reduction of Waste through Research Studies in the Operating Departments of Retail Stores—a summary of results of recent studies made by the Retail Research Association. By Philip J. Reilly, associate director, Retail Research Association, New York.

The evening session will be a Symposium on The Supervision of Personnel, the trend following the shock of the depression.

Machinery Exports Show Slight Increase

Exports of metal-working machinery during September were slightly greater than in August and materially greater than the value of the exports in September, 1921. September exports were valued at $1,093,891, as compared with $1,032,483 in August of this year and $1,074,371 in July. The detailed figures, which are those of the Bureau of Foreign and Domestic Commerce, are as follows:

EXPORTS METAL-WORKING MACHINERY

	August, 1922	September, 1922
Lathes	$52,963	$54,874
Boring and drilling machines	31,370	40,628
Planers, sharpeners and slotters	11,980	15,758
Bending and power presses	16,061	11,085
Gear cutters	15,290	14,667
Milling machines	27,631	29,662
Sawing machines	3,145	5,041
Thread cutting and screw machines	13,530	22,924
Punching and shearing machines	6,735	7,171
Power hammers	10,534	20,886
Rolling machines	734	3,897
Wire-drawing machines	1,665	81
Polishing and burnishing machines	396	1,265
Sharpening and grinding machines	79,356	56,468
Chucks, centering; lathe, drill and other	23,566	18,676
Reamers, cutters, drills and other parts for machine tools	100,295	114,475
Pneumatic portable tools	44,772	35,389
Foundry and Molding machinery	70,228	44,436
Other metal-working machinery and parts of	522,232	596,508
Total metal-working machinery	$1,032,483	$1,093,381
IMPORTS		
Machine tools	$18,926	$20,950

A.S.T.M. 1923 Annual Meeting

The Executive Committee of the American Society for Testing Materials has voted to hold the 1923 Annual Meeting of the Society at Atlantic City in the latter half of June provided satisfactory arrangements can be made. Two dates are tentatively under consideration, viz.; (1) during the last week in June, *i.e.*, June 25 to 29 and (2) immediately following the meeting in Atlantic City of the American Railway Association, *i.e.*, about the middle of June. Announcement of the exact date will be made in these columns as soon as a definite decision is reached.

A.S.M.E. Elects Division Committees

The American Society of Mechanical Engineers, during the past week, announced the elections of the executive committees of the professional divisions. Among the committees selected are the following:

Machine Shop Division: F. O. Hoagland, Worcester, Mass.; Henry J. Eberhardt, Newark, N. J.; Forrest E. Cardullo, Cincinnati, Ohio; George E. Greenleaf, Plainfield, N. J.; and Charles R. Gabriel, Brooklyn, N. Y.

Management Division: R. A. Wentworth, chairman, W. Herman Greul, Alonzo Flack, L. P. Alford and Robert T. Kent, New York City.

Materials Handling Division: H. V. Coes, Philadelphia, Pa., chairman; Fred M. Feiker and R. M. Gates, New York City; Kern Dodge and H. E. Birch, Philadelphia, Pa.

Ordnance Division: Waldo H. Marshall, New York City, chairman; Lieut. Col. G. L. Wall, Aberdeen Proving Grounds, Aberdeen, Md.; Major Wilford J. Hawkins, Bloomfield, N. J.; Col. C. L'H. Ruggles, Ordnance Department, Washington, D. C.; and Major Fred J. Miller, New York City.

Power Division: John H. Lawrence, New York City, chairman; Ervin G. Bailey, Cleveland, Ohio; A. G. Christie, professor of mechanical engineering at Johns Hopkins University, Baltimore, Md.; C. F. Hirshfeld, Detroit, Mich.; and Nevin E. Funk, Philadelphia, Pa.

Railroad Division: James Partington, New York City, chairman; William Elmer, Altoona, Pa.; E. B. Katte, New York City; W. H. Winterrowd, Montreal, Canada; and Burton P. Flory, Middletown, N. Y.

Aëronautic Division: Major Thurman H. Bane, U. S. Air Service, McCook Field, Dayton, Ohio, chairman; Joseph A. Steinmetz, Philadelphia, Pa.; Elmer A. Sperry, Brooklyn, N. Y.; Lieut. R. S. Barnaby, U. S. Navy, Philadelphia, Pa; and Sanford A. Moss, Lynn, Mass.

6th Annual Industrial Conference of New York State

"Elimination of Waste in Industry" will be the central theme of the Sixth Annual Industrial Conference of the State of New York which will be held in Buffalo, Nov. 21, 22 and 23, at the Hotel Lafayette.

Among the speakers on the program who will address the conference are the following: Hon. Henry D. Sayre, Industrial Commissioner; Governor Nathan L. Miller; W. D. Baldwin, Chairman of the Board, Otis Elevator Co.; L. W. Wallace, Vice Chairman, Federated Engineering Societies; M. F. Simmons, General Electric Co.; H. C. Blagbrough, H. H. Franklin Co.; Dean Dexter F. Kimball, Cornell University, and W. R. Bassett, Miller. Franklin & Bassett Co.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

THE economic effect of the election is quite as important as the political realignment that it will bring about. Some maintain that the reduction in the Republican vote was due simply to popular petulance at the failure of Congress to reduce taxes and expenditures. Others assert that it reflects a widespread demand for a policy that will equalize the inequalities of life and correct the alleged unfairness with which the rewards of human effort and enterprise are distributed in this wonderful country of ours.

In our consideration of the subject we shall probably be led astray if it is assumed that the masses are much concerned about taxation or government expenditure. The only direct Federal tax is that levied upon incomes. In 1920 there were but 226,120 persons who reported taxable incomes of as much as $10,000 or more. This is a politically negligible portion of the population and while the rest of the people resent the fact that so much of the country's wealth is concentrated in the hands of the few they take a certain satisfaction in the belief that these few pay most of the taxes and in this belief the many are not acutely conscious of the burden of indirect taxation that is passed on to them.

Corroborative evidence of this statement is furnished by the election in the State of New York, where the candidate whose chief recommendation was his economy went down to defeat.

Nor will the careful student of the political map be inclined to agree with those who assert that the tariff was a major influence in the election. The democratic papers succeeded in making something of a bogey of it, but it has not been long enough in force to increase seriously the cost of living and while it has its iniquitous aspects the average American voter is not much moved by economic abstractions. His grievances must become concrete before he is willing to abandon his party affiliations to protest against them and it can hardly be said that the higher prices which must ultimately be the result of the higher duties have as yet become painful realities.

We may therefore conclude that the changed majorities were not so much a protest against taxation or extravagance or the tariff as against the inequalities of economic opportunity and rewards of which the social reformers talk so much.

The outstanding fact of the election is the triumph of the Progressives. Its explanation is to be found in the promises they made. In nearly every case they pledged themselves to improve the economic condition of the large majority of the people who feel themselves oppressed. In the agricultural states the elected candidates were those who promised higher prices for the products of the soil. In the industrial regions the nominees who were supposed to be in sympathy with the wage earners got the largest vote and in the State of New York the enormous majority given to "Al" Smith is generally interpreted as a protest against the power of wealth that Governor Miller is rightly or wrongly supposed to represent.

The net result of the election is that the balance of power in both houses of Congress as well as in several state legislatures will be held by a few men who are known to be anti-capitalistic in their views.

The outstanding fact of the election is the triumph of the Progressives. Its explanation is to be found in the promises they made. In nearly every case they pledged themselves to improve the economic condition of the large majority of the people who feel themselves oppressed.

A Coalition of the newly elected Representatives and Senators who call themselves Progressives with the Agricultural "Bloc" will bring into existence a minority unit than can hold up all legislation of which it does not approve. Some of the members of this unit are already on record as interpreting the vote cast last Tuesday into a demand that farm and industrial labor shall be awarded a larger and more equitable share of the wealth that it produces. This means that capital will get less. The justice of this demand need not be here discussed, nor is it possible to say whether it can be successfully resisted by those who may oppose it. The indications are that an attempt to meet it by legislation will probably be made, and if this attempt is made it is likely to prove a disturbing if not a depressing factor in so far as security values are concerned.

Conversely, it is likely that the Progressives will regard themselves as commissioned to find a way to raise wages as well as the prices of farm products. If this is attempted a further advance in both raw materials and manufactured articles may be expected until the law of supply and demand, which is superior to man made statutes, reasserts itself.

But it is not to be expected that these prophetic generalizations will immediately become realities. The newly elected Congress will not meet until the fourth of March and while the special session of the old Congress that has been called by the President will convene November 20th, it is unlikely that it will venture to increase its unpopularity by enacting the Ship Subsidy bill or any other legislation that will involve further demands upon the treasury or the tax-payer.

A winter of comparative quietude politically and financially is therefore indicated. The impetus which the business improvement now in progress has acquired ought not to be exhausted before the spring.

The developments of the past week have not been specially important except in the cotton market, where the feeling of alarm at the prospective scarcity in the world's supply of the raw material has led to a further advance of over two cents. No one knows at what price the advance will be checked.

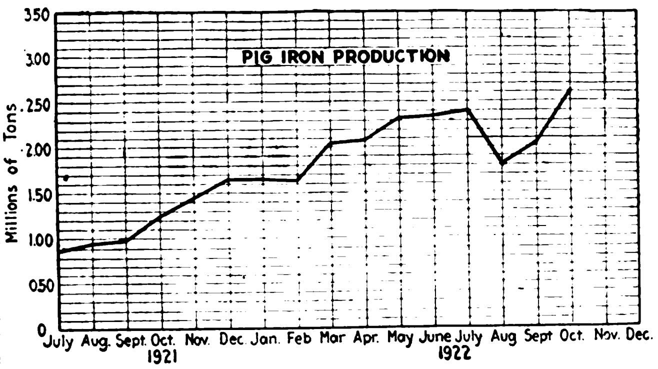
The other two important textiles, silk and wool, are likewise firm, but in no other department of our domestic trade is the upward tendency of prices as pronounced as it was two or three weeks ago. The market for building material is distinctly easier because the railway congestion has led many builders to suspend operations for the winter or until they can get prompter delivery of the supplies they need.

The market for bonds and stocks has changed but little since Wednesday, when it opened at a slight decline upon the news of the elections and promptly recovered the ground lost because the outside public did not seem disposed to follow the lead of the professionals in selling. The money market has been quiet. It is firm but not appreciably higher. The weekly statement of the Federal Reserve System shows a gain of $2,700,000 in the gold held and an advance of $\frac{1}{10}$ of one per cent in the reserve ratio, which now stands at 76.4.

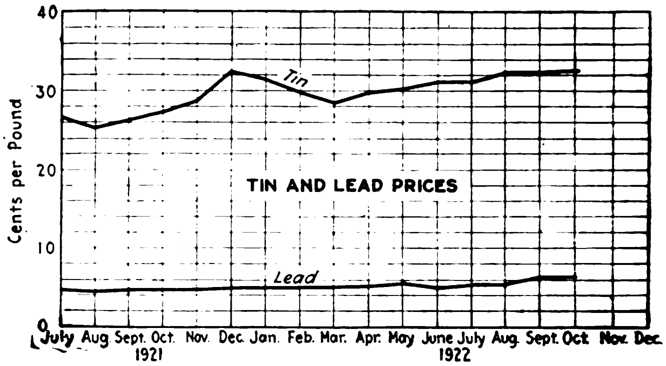
The continued decline in French and Belgian francs has been a feature of the foreign exchange market. It is attributed to the gradual abandonment by France of the hope that she will collect any substantial portion of the reparations claimed from Germany whose paper marks are practically worthless at $1\frac{1}{4}$ cents a hundred.

There are but few other European developments that call for comment. The Turks are again becoming turbulent but England seems undisturbed. Despite the financial plight of the various continental governments private business in Europe appears to be on the mend and Russia in particular seems to be commencing to emerge from its economic disorder now that the Soviet government has countenanced the resumption of trade and consented to a partial recognition of the rights of capital.

Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Institute.



Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



Pig iron production advanced sharply during October the output for the month totaling 2,683,840 tons as compared with 2,003,722 tons in the month previous. The October production represents the largest tonnage reached in any single month since December, 1920, at which time 2,703,855 tons were manufactured. The increase of 30 per cent over September is the largest gain recorded in any single month since March, 1918. During the month there was an increase of 29 stacks in operation, a total of 218 being in blast on November 1st, the first time during the year the figure has exceeded 200.

Tin and lead prices were strong and higher during the month as compared with the average for September. The average for the former was 33.935 cents as against 32.134 cents while lead averaged 6.530 as compared with 6.110 cents in September. Toward the end of the month both metals were affected by increased activity with higher prices resulting, but the activity has been of a speculative character. There is no scarcity of either metal, reputable consumers being able to secure their requirements.

Automobile share markets worked higher during October, ten representative issues moving up to an average of $46.52 per share as compared with $45.65 in September. The high point in the movement which began in August was reached about the middle of October with an average of $47.60 per share. Since that time there has been a gradual decline, the average price on October 30 reaching $45.00. Seasonal falling off in demand has been the chief weakening factor.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

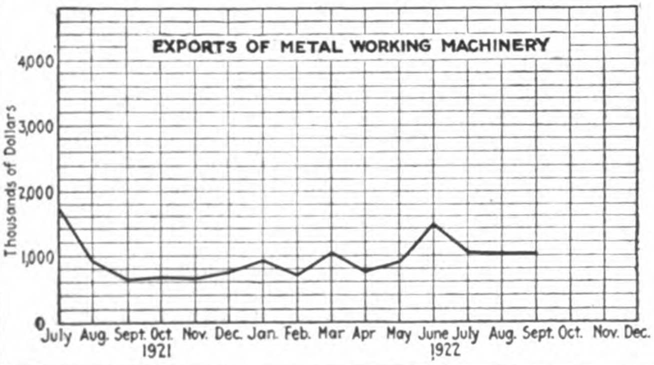
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.	$0.0295	$0.0295	$0.0273
Cold finished shafting......	per lb.	0.0378	0.0378	0.0373
Brass rods.....	per lb.	0.171	0.1700	0.15
Solder (½ and ½)	per lb.	0.24	0.23	0.20
Cotton waste..	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100.	3.11	3.11	......
Lard cutting oil	per gal.	0.59	0.575	....
Machine oil....	per gal.	0.36	0.36	....
Belting, leather, medium......	off list.	30–10% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list.	55% @60%	50%@ 65–10%	50%@ 60–10%

Metal working machinery exports continue to hold up well, September shipments being valued at $1,093,891, a slight increase over the August total of $1,032,483. This is the highest total recorded during the current year and compares with shipments in March valued at $1,057,106 and July, valued at $1,074,371. As compared with the month of September, 1921, the figures show an increase of $467,705. Imports of tools continue in small volume and were valued at $20,950 as against $18,926 in August. Machinery exports to South America are increasing but industrial, and financial conditions in Europe must improve considerably before any great impetus can be expected in metal working machinery exports on the whole.

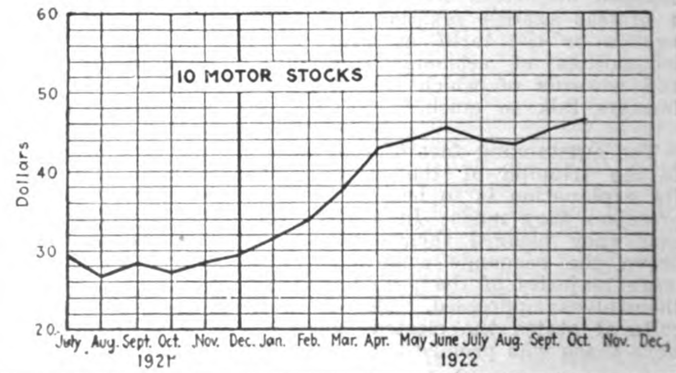
American foreign trade for September shows exports valued at $307,457,198 and imports of $228,794,639, as against August exports of $301,804,618 and imports of $281,412,910. As compared with September, 1921, imports show an increase of nearly $50 millions while exports declined about $10 millions.

Railway earnings on American roads increased slightly during September, Class One railroads reporting a net operating income of $58,428,000 as against $52,579,799 in the month previous.

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Average price of ten automotive stocks: Chandler, General Motors, Hupp, Int. Motors, Pierce, Stewart, Stromberg, Studebaker, White, Willys.



Alabama to Be Center of Pipe Industry

According to a recent bulletin by the Southern Metal Trades Association establishment of several new pipe plants in the Birmingham district the past several months has resulted in making that district the largest manufacturer of cast-iron pipe in the world, with Birmingham and Anniston, Ala., the two larger centers. In the latter city there are about fifteen large plants manufacturing pipe, while Birmingham has the largest individual pipe plant in the world. This plant produces approximately 13 per cent of all cast iron pipe made in the United States. More than 50 per cent of all pressure and soil pipe made in this country is produced in the district.

Plan Exhibit of Inventions and Patents

Announcement has just been made by A. B. Cole, vice-president of the Universal Patent Exposition Corporation, with executive offices at 110 West 40th St., New York City, of an exposition of inventions and patents to be held in Grand Central Palace, in that city, February 17 to 22, 1923.

The object of the exposition is to give all inventors an opportunity to show the public, the manufacturer, the merchant, and the financier the possibilities for utility, business, trade and commerce that are to be found in the products of their genius.

The opening day of the exposition, Saturday, February 17, has been named International Day, each of the five days following being named in honor of Marconi, Steinmetz, Edison, Bell and Westinghouse.

Freight Loadings Make High Record

Loading of revenue freight during the week which ended on Oct. 28 amounted to 1,014,480 cars, according to reports received today from the railroads of the country by the Car Service Division of the American Railway Association.

This was the largest number of cars loaded with revenue freight during any one week in the history of the railroads, except for the week of Oct. 15, 1920, which exceeded this total by only 4,059 cars, or two-fifths of one per cent. This also was the second consecutive week that freight loadings have exceeded the million mark.

Loading for the week of Oct. 28 this year was an increase of 10,721 cars over the week before, and an increase of 63,096 cars over the corresponding week last year. It also was an increase of 33,238 cars, or 3.4 per cent above the corresponding week in 1920 when the total was 1,008,818 cars.

While the total loading for the week was slightly below that for the week of Oct. 15, 1920, which was the largest on record, an analysis shows that there is a more widespread stimulation in business now than two years ago. The seasonal decline in loading usually begins around Oct. 15, but comparisons show an increase in the loading of agricultural products and all other commodities as well.

Bad Order Locomotives Show Decrease

Reports received last week from the railroads of the country by the Car Service Division of the American Railway Association show a steady improvement in the condition of motive power belonging to all carriers.

On Oct. 15 last, 19,231 locomotives, or 29.8 per cent of the total on line, were in need of repairs, according to these reports.

This was a reduction of 496 locomotives during the first half of October, there having been 19,727, or 30.6 per cent, in need of repairs on Oct. 1.

Of the total number on Oct. 15 last, 15,935 were in need of repairs requiring more than 24 hours. This was a decrease since Oct. 1 of 378 locomotives in the number requiring heavy repairs. Reports also showed 3,296 locomotives in need of light repairs which was a decrease of 118 within the same period.

At the same time the railroads of the United States had on Oct. 15, 45,187 serviceable locomotives compared with 44,703 on Oct. 1, an increase of 484.

From Oct. 1 to Oct. 15, 11,404 locomotives were turned out of the shops. This was an increase of 191 over the last half of September.

French Steel Industry Improving Rapidly

Commercial Attache Jones, in a cable to the Department of Commerce, reports marked and continued improvement in the French iron and steel industry.

During the first eight months of 1922, France produced 3,136,000 metric tons of pig iron and 2,809,000 metric tons of ingot steel. There were 98 blast furnaces active on the first of September, 61 furnaces ready to operate, and 62 furnaces being constructed or repaired. The general condition of the iron and steel industry is continuing to improve, due especially to a lack of German competition. Depreciation of the franc favors exports, but domestic demand is slightly calmer. Prices are firm or rising. Producers have orders several weeks ahead, and stocks are low, particularly those of pig iron and semi-finished products.

Strong Tendency Marks Southern Iron Market

According to the Southern Metal Trades Association the iron market in the Birmingham district still is at comparatively high prices though there is a very noticeable tendency for the prices to ease off. Many of the makers that were asking $30 a week or ten days back have reduced to $28 in the competitive fields, while the market can be said to stand at $27.50 to $28 per ton. Further slight reductions are looked for and in another week average prices probably will be around $27. Excellent sales still are reported, with the outlook better than it has been in many months. Many manufacturers in the district look for 1923 to usher in another period of inflation, but expect conditions to hold stable enough that the disastrous after effects will not prevail such as followed the last period immediately after the war.

Steel Production in South Africa Growing

Steel production in South Africa is making considerable progress, according to a report to the Department of Commerce from Trade Commissioner Stevenson, though not as much as had been anticipated.

The Union Steel Corporation (of South Africa) Limited, Mr. Stevenson says, is by far the most important factor in the industry, its 1921 production being 14,434 tons of a value of £361,468. The greater part of the output, or 11,573 tons, consisted of open-hearth steel made from scrap materials, while 2,861 tons were made in a 3½-ton Heroult electric furnace. A new 22-inch mill is being installed to roll heavier sections of angles, channels, girders, and similar products from 20 to 30 pounds per foot, and rails up to 60 pounds per yard. A new 25-ton Siemens open-hearth furnace has been erected and when in full working order the capacity of the works will be 30,000 tons a year. The Union Steel Corporation has already supplied a large part of the reinforcing steel contract for the government grain elevators, and has rolled a few rails which have been purchased by the South African Railways for trial purposes.

The Dunswart Iron and Steel Works, Limited, turned out 5,355 tons of iron, valued at £123,165 in 1921. A new 3-roll high 18-inch cogging mill is in the course of erection. It is intended later to manufacture steel castings up to 7 tons in weight.

The Witwatersrand Co-operative Smelting Works, Limited, has erected a new plant at Driehoek, to which the old equipment is being transferred. The capacity of the new plant will be 4,500 tons per annum. The 1921 output was 1,296 tons of shoes and dies, worth £25,900, as against 1,201 tons in 1920, valued at £24,020.

The South African Iron and Steel Corporation, Limited, at Pretoria, was able to operate only during the first four months of 1921, the output being 1,148 tons of pig iron, valued at £11,480, which was slightly below the 1920 figures.

It would appear, Mr. Stevenson concludes, that the local industry has not as a whole made the progress that was anticipated, even allowing for the depression period. Whether the new Iron and Steel Industry Encouragement Act will prove sufficiently attractive to interest capital is open to some question.

Jones & Laughlin Assisting Carnegie Tech Students

To assist students working their way through Carnegie Institute of Technology, the Jones & Laughlin Steel Co., of Pittsburgh, has arranged to employ students in the steel mills on Friday and Saturday nights or all day Saturday. The shifts are of ten hours length.

Jones & Laughlin Co. is the first large concern in Pittsburgh to come to the aid of students in need of finances. The arrangement is pleasing to the administration at Carnegie Tech because of the opportunity it gives to the students in the College of Engineering to acquire practical as well as theoretical knowledge.

Westinghouse Makes Personnel Changes

A number of changes in the personnel of the district offices of the Westinghouse Electric and Manufacturing Co. have been announced by W. S. Rugg, general sales manager of the company.

In the Pittsburgh office, the power division has been changed to the central station division with Barton Stevenson as manager. Mr. Stevenson will also be in charge of the sale of supply apparatus throughout the entire Pittsburgh district. The railway division has been changed to the transportation division, with F. G. Hickling as manager. A merchandising division has also been organized of which F. C. Albrecht has been appointed manager.

A transportation division has been organized in the Philadelphia office and Thomas Cooper has been appointed manager. A central station division has also been organized with H. L. Moody as manager. Mr. Moody will also be in charge of the sale of supply apparatus in the Philadelphia district, assisted by H. F. Brinckerhoff, who has been appointed assistant manager of the central station division. W. P. Cochran will temporarily have charge of the merchandising division, which has been newly formed.

Similar changes have also been made in the Detroit office. A central station division has been established with L. Whiting as manager. Mr. Whiting will also have charge of the sale of supply apparatus. F. D. Koelbel has been made acting manager of a newly created merchandising division. A transportation division has been established with R. L. Hermann as manager.

Changes in address have been made by the St. Louis and Los Angeles offices. The former office is now located at 717 South Twelfth St., St. Louis, and the latter at 420 South San Pedro St., Los Angeles.

Business Items

The Simplex Wire and Cable Co., of Boston, announces the establishment of a branch office in New York City at 120 West 32d St., with Joseph G. Brobeck as manager. Mr. Brobeck has sold Simplex wires and cables in the New York territory since March, 1920, previous to which he was connected with the Simplex sales organization at Boston for nineteen years.

The Reed-Prentice Co., Worcester, Mass., is to sell the Whitcomb-Blaisdell Machine Tool Co. factory on Gold St., Worcester, and will distribute the work in the other plants of the company in Worcester. The Becker Milling Machine Co. plant at Hyde Park, Mass., will be removed to Worcester, and the Hyde Park property sold. The Becker plant has been controlled by the Reed-Prentice interests for a number of years.

The Parker Metal Goods Co., of Worcester, Mass., has recently been incorporated under the laws of Massachusetts, with a capital stock of $50,000, to manufacture and deal in metal products, specialties, etc. Arthur H. Parker, 3 Roseland Road, Worcester, has been elected president and treasurer of the company.

The Manufacturers Machine Tool and Supply Co., Inc., of Bridgeport, Conn., has recently been incorporated under the laws of Connecticut, to engage in the handling of machine tools, machinery, and mill supplies, etc. The capital stock is $50,000, and the incorporators are: T. Leo Lalley, 647 Water St.; Ambrose A. Johnson, and Albert E. Wright, all of Bridgeport.

Alvord Reamer and Tool Co., Millersburg, Pa., announces the appointment of Paul A. Cuenot as mechanical representative to furnish special tool service to customers. Mr. Cuenot was formerly connected with the American Locomotive Co. and the Pennsylvania Steel Co.

The Black & Decker Manufacturing Co.'s Philadelphia branch office and service station, formerly located at 318 North Broad St., has re-located, the new address being 824 North Broad St. The new quarters are much more commodious and up-to-date than the old ones.

The Mack Trucks, Inc., for the quarter ended Sept. 30, 1922, reports net earnings of $1,205,733, after deducting charges for maintenance, depreciation, repairs, etc., compared with $12,633 earned during the same period last year.

The Hudson Motor Car Co. for the quarter ended August 31, 1922, reports a net income of $3,656,218, after Federal taxes, or more than $3 a share on the outstanding capital stock. The income account for the quarter showed profits of $4,183,327; reserve for Federal taxes, etc., $527,109; net income, $3,656,218; dividends, $600,247, and a surplus of $3,055,971.

The United States Hoffman Machinery Corporation for the quarter ended Sept. 30, 1922, reports gross sales of $1,528,241, against $1,381,200 in the previous quarter. Net income, after all expenses, but before taxes, totaled $255,435, against $214,984 in the previous three months.

The Seneca Falls Manufacturing Co. of Seneca Falls, N. Y., makers of machine tools and specializing in lathes has been placed in the hands of a receiver by Federal Judge Cooper. Kenneth Bartlett, assistant treasurer of the corporation and William McGreevy of Geneva have been appointed receivers. The petitions filed in Federal court show assets of $673,000 and liabilities of $238,000. The liabilities largely consist of bonds involving $210,000 held by banks and protected by real property said to be worth considerably in excess of the total debts. The capital of the company comprises $500,000 in preferred stock and 15,000 shares of common stock of no par value. The report shows that the business of the company during 1921 and 1922 has been about ten per cent of normal.

The Harrisburg Bar Mill plant, owned by J. K. White, has been purchased by the Harrisburg Pipe and Bending Co., and will be operated by the new firm. E. C. Frey is general manager and treasurer of the Harrisburg Pipe and Bending Co., Harrisburg, Pa. No immediate changes are contemplated.

The Reliance Gauge Column Co., Cleveland, Ohio, announces that its Cleveland Clutch business has been sold to The Western Engineering and Manufacturing Co., 360 E. Grand Ave., Chicago, Ill., which has been incorporated as a subsidiary of the Western Valve Bag Co. for the purpose of taking over the manufacture and marketing of this clutch.

The M. and H. Piston Ring Co., capitalized at $100,000, has filed articles of incorporation with the county clerk in Oakland, Cal. The directors are: John and Charles I. Chartz, Chas. A. McCharles and R. C. Savage, all of Carson City, Nevada.

The Cleveland Twist Drill Co. announces the retirement on November 1, of E. G. Buckwell, secretary and sales manager of the company.

The Scovill Manufacturing Co., manufacturer of brass goods, etc., Waterbury, Conn., is planning the increasing of its capital stock from $5,000,000 to $15,000,000, the amount of increase to be divided into 100,000 shares of $100 par value each. The authorization of the increase was granted the company at the last session of the State Legislature.

The Wm. H. Field Co., machinery dealer, 39 Washington St., North Boston, Mass., is erecting a large one-story 60 x 250 brick and frame machinery warehouse for its own use on Dorchester Ave., South Boston.

The Bee Machine Co., of Lynn, Mass., has recently been incorporated under the laws of Massachusetts, to conduct a general machinist business. The capital stock is $15,000, and the officers chosen are: Frank S. Belliveau, president; Melvin P. Rhodes, vice-president; and Vincent W. Burke, of 32 Baker St., Lynn, treasurer.

The Dunbrack Tool and Die Co., of Waltham, Mass., has recently been incorporated under the laws of Massachusetts, with a capital stock of $20,000. Warren H. Dunbrack has been elected president; and Norman K. Dunbrack, Prospect Hill Ave., Waltham, has been elected treasurer.

Charles J. Britt, of Wilmington, S. C., and P. T. Jones, Jr., of Corinth, Miss., are engaged in the formation of a company that is to establish a plant, probably at Wilmington, for the manufacture of a new traction engine and tractor recently invented and patented by Mr. Britt.

The Norwalk Iron Works Co., pioneer builder of compressors, manufacturing air and gas compressors for all purposes and also refrigerating machinery, with general offices and works, South Norwalk, Conn., has just opened a Chicago office. It is located at 627 W. Washington Boulevard and is in charge of L. R. Bremser who, for thirteen years, was associated with The Gardner Governor Co.

The Cleveland Twist Drill Co., announces the appointment of W. E. Caldwell, formerly assistant sales manager, to the position of sales manager to succeed E. G. Buckwell, recently retired.

The Inopco Corporation has been organized and incorporated in Atlanta with $200,000 capital, to establish a plant in that city for the manufacture of machinery used in the extraction of

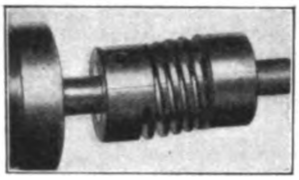
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Milling Machine, Four-Spindle, Knee-Type, Model C-76
Consolidated Machine Tool Corporation of America, New York, N. Y.,
Newton Machine Tool Plant, Philadelphia, Pa.
"American Machinist," September 28, 1922

The machine is intended for facing and slotting connecting rods in one operation and at high speed. The drive is by belt transmitted directly to the spindles by worms and wormwheels. The four spindles have tapered ends and individual adjustment for varying the distance between the spindle centers. The vertical feed of the table gives a quick upward movement to the knee, and changes to a slow feed for the cut and then to a quick downward movement after which it automatically stops, allowing the table to be indexed. Each fixture has an individual adjustment for varying the distance between the rods. Floor space, 60 in. square.

Coupling, Shaft, Flexible, Cut-Spring
Steel-Flex Coupling Corp., 1712 First National Bank Bldg., Detroit, Mich.
"American Machinist," September 28, 1922



The coupling is all-steel, has a machine cut spring and is made for shafts up to 1 in. in diameter. Its body is formed from a cylindrical tube and hollow-head safety screws secure it to the shafts. The device is intended for direct connecting light-duty motors to small drilling machines or other tools where shafts are slightly out of line and where it is desired that the coupling should reduce the friction in shaft bearings and act as a shock absorber on sudden starts. By bending in the spring, the coupling allows for both angular and parallel misalignments. A standard line of coil-spring flexible couplings for shafts from 1 to 12 in. in diameter is also furnished.

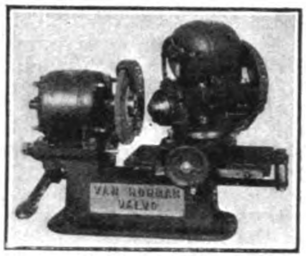
Marking Machine, Bench-Type, No. 13
Noble & Westbrook Manufacturing Co., Hartford, Conn.
"American Machinist," September 28, 1922

The machine is small, inexpensive and capable of marking four lines of $\frac{1}{16}$ in. lettering on flat or cylindrical articles up to 2 in. in diameter. The marking is done by means of cylindrical steel marking dies. On flat articles the die rolls over the work, and on cylindrical articles both the die and the work roll together. Pressure is applied from the top and not upward through the table as in the larger models. The table can be raised by a handwheel in steps of thousandths of an inch and locked in the proper position. It is furnished with one die holder of suitable design for either flat or cylindrical parts. Bench space, 10 x 12 in. Weight, 60 pounds.

Dresser, Wheel, for Vertical Surface Grinding Machine
Pratt & Whitney Co., 111 Broadway, New York, N. Y.
"American Machinist," September 28, 1922

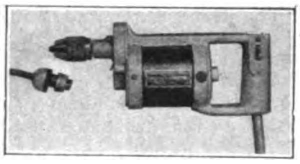
The device is for dressing wheels of vertical surface grinding machines without the danger of injury to the operator. It consists of a bracket bolted or riveted to the wheel guard and supporting the stem on which the dresser proper is pivoted. The dressing wheels are held in one end of a bent bar so that they come to position on the face of the wheel. The other end of the bar forms a handle so that the wheels can be easily moved into position. The dressing wheels can be moved on the face of the grinding wheel in the same manner as the hand dresser is employed. No change in the set-up of the work or wheel is necessary when the dressing is done.

Grinding Machine, Poppet Valve, Self-Contained, Small, "Valvo"
Van Norman Machine Tool Co., Springfield, Mass.
"American Machinist," September 28, 1922



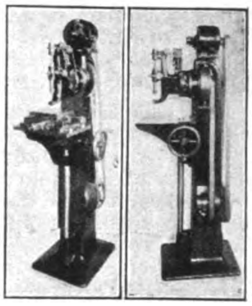
The machine is for grinding the poppet valves of automotive engines. The grinding wheel is mounted directly on the shaft of a $\frac{1}{4}$-hp. motor, while the work head spindle is driven by gearing from a 1/20 hp. motor. The swiveled work head is carried on a movable slide operated by a handle at the left. The valve stem is held in a split draw-in collet which has a capacity up to $\frac{9}{16}$ in. in diameter. The valve is passed across the face of the wheel, while the work is fed to the abrasive wheel by the hand feed wheel at the right. The reamer for the valve seat can be ground at the same setting. Length, 20 in. Width, 15 in. Height, 16 in. Wheel size, 6 x $\frac{3}{8}$ in. Weight, 110 pounds.

Drill, Electric, Portable
Titan Manufacturing Co., 140 So. Dearborn St., Chicago, Ill.
"American Machinist," September 28, 1922



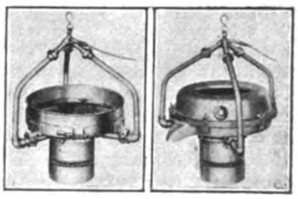
The drill is of the universal type and will operate on either a.c. or d.c. It runs at high speed on light loads and slows down on the heavier loads, providing the proper change in speed for different sizes of drills. The windings are coated with a special compound and baked 90 hours, resulting in a solid coil from which the wires cannot work loose. A vent is located in both the upper and lower branches of the handle, the air being discharged in front of the housing. A spring stop holds the armature from turning when opening or closing the chuck. The quick-break switch located in the handle of the drill can be operated by the thumb.

Drilling Machine, Laying Out, K-N
E. L. Krag & Co., 50 W. Randolph St., Chicago, Ill.
"American Machinist," September 28, 1922



The machine is intended for use in conjunction with the Johansson compound slide and blocks for locating holes. A rigid arm extends below the point of the drill so that a bushing of the correct size for the drill can be located just above the surface of the work. The table of the machine is adjustable for height. The spindle housing and the bracket holding the guide bushings are cast in one piece. Six speed changes are provided of from 400 to 4,300 r.p.m. As a routing or milling machine, the tool can be operated with a single-lip cutter. The head of the machine swings 360 deg. It may be removed from the column and mounted on a milling machine.

Sifter and Strainer, Portable, Electric-Driven
J. D. Wallace & Co., 1401 W. Jackson Blvd., Chicago, Ill.
"American Machinist," September 28, 1922



The device is for rapidly sifting and straining and can be hung from any convenient support. The extreme motion of the riddle is only $\frac{1}{16}$ in. from its central position. The motor is connected directly to the riddle. The armature and the shaft of the motor remain stationary and the field and housing revolve at high speed, giving an eccentric or circular vibrating motion to the riddle. A valve trap at the air intake keeps out the dust and dirt. An 18-in. riddle having a No. 2 screen is ordinarily supplied. The straining attachment at the right has considerable capacity both above and below the screen. The device requires very little head room.

Clip, paste on 3 x 5-in. cards and file as desired

vegetable and other oils. James W. Conway and Edward P. Thompson, of Atlanta, and Herman Bollmann, of Hamburg, Germany, are the incorporators.

The Abrasive Co., Philadelphia, Pa., manufacturer of grinding wheels and abrasive materials, is now operating at 90 per cent capacity, according to reports issued by the company.

The Warren & Irrgang Co., of 238 Dwight St., Springfield, Mass., has bought the factory building in Chicopee, formerly used by the S. Blaisdell, Jr., Co., at a price of $18,000, for the expansion of their production of factory trucks and tractor trailers, and will remove their operations there as soon as necessary alterations have been made in the building.

The Southern Metal Trades Association, headquarters of which are in Atlanta, has started publication of an official monthly organ under the name of The S. M. T. A. It is devoted to a discussion of southern industrial conditions largely, and is edited by William E. Dunn, Jr., secretary of the organization.

The Rabe Pipe and Foundry Co., of Chattanooga, Tenn., according to a recent announcement by R. R. Rabe, president of the company, is planning the immediate construction of a large addition to its present foundry that will increase the daily capacity to about 100 tons. The plant is at North St. Elmo, just outside Chattanooga.

The Facto Motor Trucks, Inc., Springfield, Mass., has taken out a building permit for a brick, steel and concrete building to cost $35,000, to meet the requirements of the company's new 2½-ton truck about to be put into production. The building is to be located at 296 Pecousic Boulevard, where the company already has a small building in which the experimental work has been done. Adolf A. Geisel is manager, and H. G. Farr, formerly chief engineer for the Knox Motors Co., is in charge of plant production.

The Independent Pneumatic Tool Co., Chicago, announces that Harry J. Reefe, formerly manager of the order department of the company, has just been appointed to the position of purchasing agent, in place of Thomas J. Keegan, resigned.

Personals

D. K. HUTCHCRAFT has been made district manager of the new branch of the Chicago Pneumatic Tool Co., at Tulsa, Okla.

E. G. BUCKWELL, secretary and sales manager of the Cleveland Twist Drill Co., and associated with that organization for the past twenty-three years, has retired from active work. He will, however, remain as a director of the company and retain his interests in it.

L. F. CARLTON, for eighteen years connected with the Consolidated Press Co., but during the past two years devoting his time to the field of farm and landscape equipment, has again become active in the press line. He has recently been appointed western sales manager of the V. & O. Press Co., of Brooklyn, N. Y.

R. H. WOOD, formerly Chicago manager of Modern Tool Co., has been appointed manager of the small tool department of the Consolidated Machine Tool Corporation, Detroit, Mich. The interests of that organization having been taken over recently by the Consolidated Machine Tool Corporation.

OTTO H. OLSON has been promoted to the position of general foreman of the Barber-Coleman Co., Rockford, Ill. Mr. Olson entered the employ of the company in 1905 as an apprentice and completed his course in 1908. Since that time he has held foremanship positions in many departments of the plant.

OGDEN R. ADAMS of Rochester, N. Y., who for the past eighteen months has been associated with the Seneca Falls Manufacturing Co., Inc., in the capacity of president and general manager, has severed his connection with that corporation, his resignation becoming effective as of Nov. 1, 1922. Mr. Adams will hereafter devote his entire time to his business interests in Rochester, Buffalo, and Syracuse.

A. H. HUNTER, president of the Atlas Steel Corporation, formed by the merger of the Atlas Crucible Steel Co., and the Electric Alloy Steel Co., has resigned.

W. NOCHUMSON, western representative of Clark Equipment Co. and Clark Tructractor Co., has moved his headquarters from 86 East Randolph to 30 North Clinton Street, Chicago, Ill.

Obituary

JOHN S. LESTER, 1185 Peachtree St., Atlanta, for the past twenty years southern representative of the Remington Arms and Ammunition Co., of New York, died recently in New York City, after an illness of about two weeks. Mr. Lester was 54 years of age.

GENERAL LUCIUS ALBERT BARBOUR, of Hartford, Conn., prominent in industrial circles of Connecticut, died at his home in Hartford, Monday, November 6, after a long illness. He was 76 years of age and at the time of his death was a director of Landers, Frary, and Clark Co., New Britain, Conn., and several other industrial organizations, and financial institutions.

HERBERT T. GRANTHAM, vice-president of the Belmont Iron Works, Philadelphia, died suddenly in that city, Nov. 5.

W. D. NORTON, for many years a prominent figure in Cincinnati business circles, died last week at Magnetic Springs, Ohio. For several years Mr. Norton and his brother, Clair H. Norton, conducted the business known as the Norton-Broadway Machinery Co., at 238 Broadway, New York City.

GEORGE T. MONTGOMERY, head of Montgomery and Co., Inc., dealers in tools and hardware supplies, 105 Fulton St., New York City, and a director in the Thompson Meter Co., Brooklyn, died at his home in New York City, November 7, at the age of 50. He was prominent in civic and club affairs. He leaves a wife, two daughters, a brother and three sisters.

Book Reviews

Export Merchandising. By Walter F. Wyman, Sales and Export Manager, the Carters' Ink Co. Four hundred and five pages, 6 x 9; 15 special inserts. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City. Price $4.

Here is a really good business book on a subject of first importance. It comes at a time when America is adjusting her glass for a broader and more minute inspection of international commerce; when the real significance of overseas trade is beginning to dawn in American industry; at a period when the county is upon the threshold of an era which will be marked by keen conquest for markets abroad and in which only the fittest and best prepared will survive.

Here and there in America are found a few products which have become international household words. A cursory examination to discover the reason for this condition develops at the outset the fact that there has been within each organization a very broard, definite and thorough foreign trade policy. Of such is Carters' Ink and to the author of Export Merchandising, Mr. Walter F. Wyman, belongs to a very great extent the credit for its success. He speaks with authority and wide experience.

The book opens with a chapter on Common Sense in Exporting Trade. It is all that the title signifies. To those who have long been in the habit of looking upon export trade as a "great business venture," who have been hypnotized by the appearance of a foreign postage stamp in their morning mail, this chapter alone is well worth the price of the book. It is a refreshing, every-day view point and shows that, fundamentally, there is but little difference between foreign and domestic business.

In the second and third chapters the desirability of entering foreign markets is stressed as a measure of insurance against dull periods at home. The necessity for establishing, at the outset, a sound export policy is made clear with common sense reasons as to why and wherefore.

With these foundations laid, the author plunges into the important matter of organizing for overseas trade, discussing at length in his characteristic practical manner the export department, its functioning, where it should be located, its manager and his qualifications, and the method of securing and training export salesmen.

Chapters XI to XVI are given over to subjects which are of prime importance to every manufacturer who now is engaged in or who may be considering the question of placing his wares on shelves in other lands. The author prepares the field for the salesman and he prepares the salesman for the field. He shows how he cooperates with him and gives his method of developing the trade by correspondence as well as his advertising campaigns.

The last half of the book, Chapter, XVIII to XXXVI are discussions of the great questions of commission houses, exclusive agents and agency contracts, sales campaigns, credits and credit risks and methods of foreign collections.

The book, on the whole, represents the thought and study of a man who has been long identified with foreign trade and whose record is one of eminent success. Its pages are filled with numerous interesting and instructive facts and the entire subject of export mechandising is presented in a manner which does not make reading a burden.

Factory Accounts in Principle and Practice. By Garke and Fells. Two hundred and ninety, 6 x 9-in. pages. Published by D. Van Nostrand Co., 8 Warren St., New York, N. Y. Price $5.

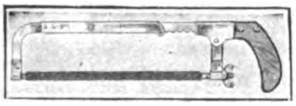
The book is a handbook for accountants and manufacturers and contains, in addition to the ten-chapter discussion of systems of factory accounting, appendices, on the nomenclature of machine details and the rating of factories, a table for the amortization of leases, a glossary of terms and a large number of specimen rulings.

The foreword has been written by Mr. Fells and describes scientific methods in business administration and management. The introductory chapter relates the history of the development of the modern factory system and emphasizes the effect of

Condensed-Clipping Index of Equipment

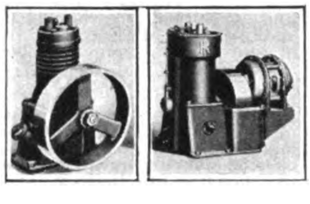
Patented Aug. 20, 1918

Hacksaw Frame, "Easy Grip"
Consolidated Tool Works, Inc., 296 Broadway, New York, N. Y.
"American Machinist," September 28, 1922



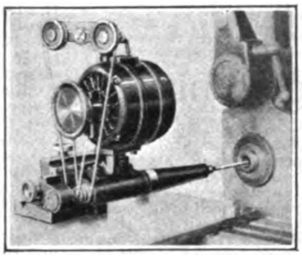
The handle of the frame is so positioned that it affords a comfortable grip for the operator, does not cramp his hand and enables him to obtain a powerful stroke. The frame is made entirely of nickel-plated steel with the exception of the wooden handle. The wing nut for tightening the blade is located at the rear or handle end of the tool, where it is out of the way. The blade may be turned to face in any of four directions.

Compressors, Air, Vertical, Small, Type 15
Ingersoll-Rand Co., 11 Broadway, New York, N. Y.
"American Machinist," October 5, 1922



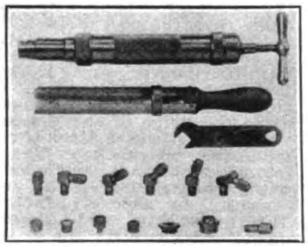
The machine is built in four sizes in either the plain belt-driven type shown at the left, or the self-contained electric-motor-driven outfit at the right. With the motor drive, the compressor may be driven by means of a pinion and internal gears, or by a short belt. It has a constant-level lubrication system, automatic constant-speed unloader in the belt-driven machine, and centrifugal unloader for controlling the starting and stopping. The smallest size may have either a ribbed, air-cooled cylinder for intermittent service or a water-jacketed cylinder of the reservoir type for constant service. All other sizes are built with the water jacket.

Spindle and Housing Extension for Thread Grinder, "Precision"
Precision and Thread Grinder Manufacturing Co., Philadelphia, Pa.
"American Machinist," October 5, 1922



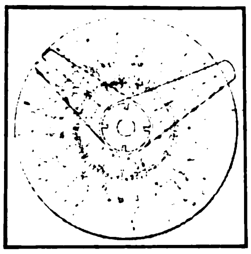
The attachment consists of an extension housing and an extension spindle and is applicable to deep internal grinding. The device has a number of uses and can be mounted on different types of machines. The extension housing is screwed directly on the threads at the front of the spindle cap of the grinder. The extension spindle couples on the end of the regular spindle by means of a tapered joint and is supported by double radial and end-thrust ball bearings at the extreme outer end of the housing. Capacity, 12-in. depth on holes 2 in. or larger in diameter; 6-in. depth on holes ½ in. in diameter.

Lubricator, Bearing, Hand-Operated, High-Pressure, "Dot"
Carr Fastener Co., Boston 39, Mass.
"American Machinist," October 5, 1922



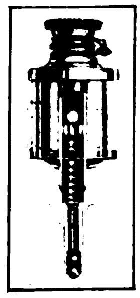
The device is for forcing oil or grease into bearings. Nipples with a spring-loaded ball in the top which automatically closes the opening, are applied to the bearing boxes and can be furnished to face at any angle. The lubricator is fitted with a plunger for ejecting the oil. The nozzle is an integral part of the device and has a special triangular shape to fit the nipples. A slight turn of the handle to the right locks the nozzle to the nipple. With further turning the valve opens and the lubricant is forced under high pressure into the nipple. A quarter turn to the left releases the nozzle and the valve automatically shuts off the lubricant.

Slide Rule, Circular, "Midget"
Gilson Slide Rule Co., Niles, Mich.
"American Machinist," October 5, 1922



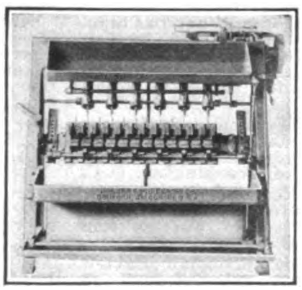
The longer indicator of the rule gives the answer to the problem that is being solved. On the back, scales give the sines, tangents, cosines and cotangents of all angles from 0 to 360 deg., and the decimal equivalents of fractions to six places. The binary scale is divided into 64ths, 32nds and 16ths, and is concentric with another for adding and subtracting decimals and fractions. Concentric with these two scales are the thread and drill size scales. Drills from 60 to 1 and from A to Z are given in thousandths or in 64th of an inch. The drill size to use with any tap of V or U. S. S. thread from 3 to 50 per in. is given. Other scales give logs to the base *e* and the base 10, as well as the square roots and corresponding powers.

Lubricator, Bearing, Ball-Feed, "Auto-Vac"
Kelly Lubricator Corporation, 107 N. Franklin St., Syracuse, N. Y.
"American Machinist," October 5, 1922



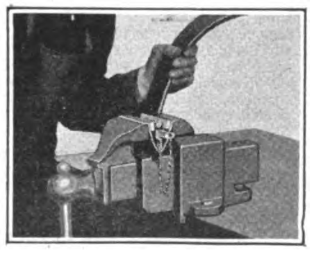
In this device a small ball fitted at the bottom of the sliding tube rests on the shaft to be lubricated. This ball is free to rotate in its tube, in which are small oil channels, and which is held in place against the shaft by means of a small spring. The oil adheres to the surface of the rotating ball and is carried to the bearing surfaces by the revolving shaft. Oil is fed only when the machine is in motion. The lubricator is made in four sizes having capacities of ¼, ½, 1 and 2 ounces.

Threading Machine, Tilted, No. 3
Holmes Engineering Co., Oshkosh, Wis.
"American Machinist," October 12, 1922



When equipped for tapping, the machine has both forward and reverse movements for the spindles. The six spindles are placed at an angle of 30 deg. from the vertical. Six of the twelve jigs employed are brought up simultaneously to the taps by a treadle while the six idle jigs are being loaded. A work shelf to accommodate two tote boxes full of parts is located just above the spindles. Capacity: internal threading, taps up to ⅝-in. U. S. S. threads, 1-in. S. A. E. threads; external threading, up to 1 in. U. S. S. or 1¼ in. S. A. E. threads. Floor space, 66 x 41 in. Height, 65 inches.

Belt-Lacer, Vise-Operated
Detroit Belt Lacer Co., Detroit, Mich.
"American Machinist," October 12, 1922



The device is for applying wire belt lacing to belting without the use of the regular bench-type closing machine. It is held open by means of a spring so that it retains its position on the vise jaws. When the vise is closed, the jaws come to the proper position to shape the lacing. The device is made of steel, while the magazine is bronze. The standard staggered-type wire belt lacing is employed. The hooks mounted on cards are placed in the closing device and the belt held in position by hand. Pressure from the vise sinks the hooks into the belt and flattens the lacing. Rawhide pins connect the lacing on the two ends of the belt.

Clip, paste on 3 x 5-in. cards and file as desired

accurate accounting on employees. Chapter II deals with labor and under this heading takes up time recorders, wages, wages book, wages journal, traveling and other expenses, factory rules, and rent, and is followed by a diagram of the assimilation of wages and commercial books.

Chapter III discusses stores, covering the purchase of material for plant maintenance, purchasing records, stores accounts, estimates to precede expenditures, consumption of material, material returned to vendor, stores rejected book, cost of processes and qualities, byproducts. The chapter ends with a diagram of the assimilation of stores and commercial books.

Prime cost and the cost ledger are the subjects of Chapter IV. The distinction between stock and stores is brought out, and standard parts, the cost ledger, channels, expenditure, work in progress, actual and estimated costs discussed. This discussion is continued in Chapter V under the heading of indirect or incidental expenses and their allocation, followed by diagrams of the assimilation of cost and commercial books.

Fixed capital and depreciation in relation to capital, to current expenditure, to railway and water companies, to reserve funds, to obsolescence, to the life of the object and to the cost of maintenance, as well as the loss on capital, the loss on revenue accounts and the income tax acts, comprise Chapter VI.

Machinery use is the subject of Chapter VII and in this connection the expenditure on the plant, the ratio between the life and the cost of a machine, the idle hour rate, the productive hour rate, the normal machine rate, the cost of fuel, the valuation of patents and goodwill, wasting assets are covered. Chapter VIII deals with stock, its distribution and sales records followed by a diagram of the assimilation of stock and commercial books. Chapter IX gives the value of surveys, stocktaking, the valuation of old material, reduction in the valuation of stocks. The discussion of factory systems is concluded in Chapter X with a description of the subsidiary books essential to accurate factory accounting. The appendices and glossary previously mentioned complete the book.

American Malleable Cast Iron. By H. A. Schwartz. Three hundred eighty-four 6 x 9 in. pages, 190 illustrations. Cloth boards. Published by The Penton Publishing Co., Cleveland, Ohio.

A welcome addition to the literature of malleable cast iron, which, to quote the author, "is limited to a single book first issued about ten years ago and now out of print, and to a series of articles of great diversity of character and quality in the technical publications of this country and Europe."

Mr. Schwartz set himself the task of writing a book for both specialist and layman, and has very well accomplished his aim. He suggests that his book may serve a useful purpose as summarizing and recording the contemporary state of the art in the metallurgy of American malleable cast iron in theory and practice. There is much that is elementary, for which the average reader will be thankful. The specialist will find there is ample content aside from that which is elementary.

A selected bibliography forms an appendix. It is classified under four general headings: General Information, Production, Metallurgy and Metallography, Properties and Uses. Two other valuable features are a complete index and a list of illustrations. It is gratifying that the first two chapters tell of the early history of ironmaking and the development of the malleable industry in the United States.

The third to nineteenth (last) chapters treat of the metallurgy and malleable iron; general manufacturing and plant; melting stock; fuel and refractories; air furnace melting; electric furnace melting; cupola and open-hearth melting; annealing practice; principles of annealing; molding and pattern making; cleaning and finishing; inspecting and testing; tensile properties; compression, bending and shear; fatigue; impact, hardness and wear; plastic deformation; and thermal and electrical properties.

Belt Conveyors and Belt Elevators. By Frederic V. Hetzel. Three hundred twenty 6 x 9 in. pages, 291 illustrations, 58 tables. Cloth boards. Published by John Wiley & Sons, Inc., 432 Fourth Ave., New York, N. Y. Price $5.00.

Knowledge acquired during 30 years' experience at drafting board, in the shop, and in the field, is given by the author in this thorough treatise on belt conveyors and elevators. The book was written for men who have material to handle—consulting engineers, designers and students. The information is given an analytical presentation most acceptable to those groups, all of which must know the how and why of the methods and equipment they deal with.

The section devoted to belt conveyors begins with a general description of their component parts, follows with a brief history of the development of belt conveyors and then takes up the subjects of belts and their manufacture, how the belts are supported, guided, driven, locked, protected and cleansed, tension devices, discharging methods, conveyors.

Belt conveyors are the subject of the second part. Divisional subjects are centrifugal discharge elevators, elevator buckets, continuous bucket elevators, belts for elevators, fastening buckets to belts, driving belt elevators, elevator boots, inclined elevators, elevator casings.

Why Manufacturers Lose Money. By Robert Grimshaw. 176 pages, 5 x 7½ inches. Published by D. Van Nostrand Co., New York. Price $2.

As stated in the preface, this book is the outcome of a series of lectures on cost reduction delivered by the author in Germany and Austria in 1913 and 1914 and later lectures in this country.

The book is divided into sections dealing with the different causes of losses, such as financial, commercial, organization, technical, personal and miscellaneous. Each cause is taken up in considerable detail and many interesting incidents are given to bear out the points made. Machine equipment, supplies and their purchase, the personnel of workers and many other factors are shown in an interesting manner. There are few who cannot get valuable suggestions from the volume.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Internal combustion engines, machinery and articles suitable for dairymen and farmers—Australia. Purchase or agency desired. Quotations, c.i.f. southeastern Australia. Reference No. 4172.

Complete installation for a large sawmill and for the manufacture of boxes and shooks—Portugal. Purchase desired. Quotations, c.i.f. Portuguese port. Correspondence, French or Portuguese. Reference No. 4186.

Machine for making sisal twine of about 12 strands, and a machine for weaving sacks of sisal twine of various sizes up to 28 by 44 inches. Machine should have a capacity of 1,000 to 2,000 sacks per day of 8 hours—Mexico. Purchase desired. Quotations, f.o.b. New York or New Orleans. Reference No. 4196.

Small locomotives for narrow-gage railway, steam rollers, crushers and all necessary equipment and material for the construction of a harbor and dock—France. Purchase desired. Correspondence, French. Reference No. 4228.

All machinery connected with printing and stereotypography—Switzerland. Purchase desired. Quotations, f.o.b. New York. Reference No. 4230.

Pamphlets Received

Labor and Industrial Conditions in China. Trade Information Bulletin No. 75, by Julean Arnold and William H. Gale of the Department of Commerce. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Algeria. Trade and Economic Review for 1921, No. 19, on the state of trade in Algeria. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Haiti. Trade and Economic Review for 1921, No. 17, on the state of trade in Haiti. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Venezuela. Trade and Economic Review for 1921, No. 18, on the state of trade in Venezuela. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

Employers Liability Laws. A compilation of laws relating to mediation, conciliation, and arbitration between employers and employees; laws, disputes between carriers and employers and subordinate officials under the Labor Board, eight-hour laws, etc. Compiled and issued by The House Document Room, House of Representatives, Carl G. Mamberg, Superintendent, Washington, D. C.

Trade Catalogs

Flexible Shaft Driven Tools. The S. S. White Dental Manufacturing Co., Philadelphia, Pa. This company has just published a new catalog of 36 pages, illustrating and describing the numerous styles of flexible shaft driven tools of its manufacture and pointing out their many uses in industrial fields, such as drilling, grinding, polishing, engraving, die sinking, reaming, chasing, sharpening, tool room work, etc.

Midwest Steel Sections. The Midwest Steel and Supply Co., 28 West 44th St., New York City. This company has just published a fifty-four page Architect's and Engineer's Data Book covering Midwest steel sections for overhead shafting layouts and anchorage of piping, cables, machinery, monorails, car tracks and other equipment. The publication has been prepared with care and is replete with illustrations and line drawings of characteristic installations.

Bullard Mult-Au-Matic Operator's Handbook. The Bullard Machine Tool Co., Bridgeport, Conn. This company has just issued a 93-page handbook for operators of the Bullard Mult-Au-Matic machines which is of exceptional value not only to present users of this type of equipment, but to all companies seeking quantity production at low cost. The handbook discusses in detail the construction features of the machine, its operation and care, methods of setting up, speed and feed data, standard tool equipment, and contains a great many diagrams, line drawings, charts and other valuable data related thereto. Every effort has been made to make the instructions complete and cover every function of the machine. The diction and diagrams are marked by simplicity and clearness.

Forthcoming Meetings

Automotive Equipment Association. Annual show and meeting, November 13 to 18, Chicago, Ill.

National Founders' Association, Fall meeting, Hotel Astor, New York City, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th Street, New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16, Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21, Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Society for Testing Materials, Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

New and Enlarged Shops

Machine Tools Wanted

Ala., Anniston—Kilby Pipe Co., (manufacturer of cast iron pipe, fittings, etc.), E. M. Kilby, Pres.—foundry and machine shop equipment.

Fla., Odessa — Dowling Bros. — power house, machine shop and lumber mill equipment.

Ga., Rome—Battey Mchy. Co., West 2nd Ave., J. Cunningham, Secy. and Treas.—gear cutter, similar to No. 13, Brown & Sharpe.

Mass., Ashland — Lombard Governor Co. (manufacturer of governors, etc.)—boring mill and tool room lathe (used).

Mass., Jamaica Plain (Boston P. O.)—W. F. Somes, 38 Green St. (machine shop)—one 15 ft. x 8 ft. to 0 in. screw cutting lathe, also small bench grinder (used).

Mo., Valley Park—Barbour Boat Co.—reversible shaper.

N. Y., Buffalo—F. L. Bumpus, Jr., 1431 Seneca St.—machinery, tools and equipment for gasoline and automobile service station at 1437 Seneca St.

N. Y., Buffalo—C. B. Druar, 233 Dearborn St.—auto repair tools for garage at 282 Franklin St.

N. Y., Buffalo—S. Jacobson, 1168 Abbott Rd.—equipment for automobile repair shop and service station on Abbott Rd. and Bailey Ave.

N. Y., Buffalo—McKaig & Hatch, Ontario and Skillen Sts.—20 or 24 in. production drill press, either 1 or 2 spindles.

N. Y., Buffalo—P. C. Schasre, 128 Arkansas St.—equipment for mechanical automobile repair shop.

N. Y., Naples—E. D. Cornish & Son—machinery, tools and equipment for garage and service station on Main St.

N. Y., Newburgh—J. F. Pittishnock, 66 Bridge St. (jewelry repairing) — power lathe, counter shaft and chucks.

N. Y., New York—A. Loewy, 200 5th Ave.—4 die presses.

N. Y., New York—Logan Constr. Co., 15 Park Row—portable Toledo pipe threading machine.

O., Columbus—Stitt Ignition Co., 16 East First Ave., (manufacturer of spark plugs) B. F. Stitt, Vice. Pres.—automatic screw machine to increase capacity.

Okla., Enid—Kingham Machine Shop, A. Kingham, Purch. Agt.—engine lathe with 14 to 16 ft. bed, also milling machine, belting, shafting, pulleys and hangers.

Pa., Nanticoke — The Nanticoke Garage Co.—machinery and equipment for proposed $65,000 garage on Spring St.

Pa., Pittsburgh — Atlantic Refining Co., Chamber of Commerce Bldg.—mechanical machinery and equipment for large gasoline and service station on Franklin and Main Sts., Titusville.

Pa., Pittsburgh—Atlantic Refining Co., Chamber of Commerce Bldg.—machinery, tools and equipment for proposed large gasoline and service station on Pennsylvania Ave. and Water St., Warren.

Pa., Pittsburgh—Neely Nut & Bolt Co., 26 South 22nd St.—lathe, shaper, grinder, miller, hacksaw, drill press and arbor press.

Pa., Pittsburgh—The Pennsylvania R.R., Pennsylvania Sta., W. G. Phelps, Purch. Agt.—list of machine tools for Columbus, O., shops.

Wis., Baraboo—Allan-Diffenbaugh Wrench & Tool Co., L. A. Maisel, Mgr.—machinery and equipment for the manufacture of wrenches, tools, etc., also power machinery.

Wis., Kiel — A. B. Bessler — drill press, lathe, emery wheel and air compressor for garage.

Wis., Milwaukee—Bahde Mfg. Co., 2621 Vine St., (manufacturer of patented mechanical articles), C. A. H. Bahde, Purch. Agt.—speed drills and emery wheels.

Wis., Milwaukee—Sun Light Aluminum Co., 280 East Water St.—29 in. power paper cutting machine and bench shears.

Wis., Racine—Heeter & Heeter, Inc., 1309 Rapids Drive, R. Heeter, Purch. Agt.—repair machinery for garage, including drill press and air tank.

Ont., Toronto—The Toronto Motor Car Ltd., 52 James St.—equipment for proposed $100,000 garage on Jarvis St.

Machinery Wanted

Calif., San Francisco—The Banner Refining Co., Kohl Bldg.—machinery for proposed refinery on Islais Creek.

Calif., San Francisco — The city and county of San Francisco, M. M. O'Shaughnessy, Engr., City Hall—receiving bids until Dec. 6 for one 4 motor electric traveling crane, 8 wheel type with maximum working load of main hoist 270,000 lbs., and auxiliary hoist 30,000 lbs. Approximate maximum speeds of operation with full working loads shall be as follows: main hoist 4 to 5 ft. per minute, auxiliary hoist 25 to 28 ft. per minute and trolley and bridge travel 60 to 80 ft. per minute.

Conn., Seymour—Seymour Mfg. Co. (copper and silver goods)—10 iron body mill trucks, length 10 to 12 ft.

Conn., Waterbury — Hamilton Bottling Wks., Burton St.—equipment for proposed bottling plant.

Fla., Apalachicola—W. L. Papham—electric refrigeration machinery.

Idaho, Nampa — Job Printer, 202 Colonial St.—complete newspaper equipment, including press, linotype, paper cutter, belting and hangers.

Ill., Chicago—Bunge Bros. Coal Co., 1648 West Lake St.—one coal crusher.

Ill., Chicago—Jointless Fire Brick Co., 1130 Clay St. — machinery for proposed brick manufacturing plant at Trenton, N. J.

Ill., Chicago—Print Shop, 1212 Addison St.—22 x 25 in. pony press.

Ill., Chicago—The Western Feed Manufacturers, 345 North Elizabeth St.—portable mechanical conveyors and pilers; automatic scales; feeders, motor power for feed mill at Rice Lake, Wis.

Ill., Morrison — Shawyer Printing Co. — galley proof press and type cabinets.

Ill., National Stock Yards—Natl. Publishing Co.—saw trimmer for power equipment.

Ind., Kokomo—E. Hersenberger, Box 602—printing press, power equipment, also hand wire stapler.

Ia., Iowa City—State University of Iowa, A. V. O'Brien Supt. of Shops—small size electric furnace, resistance type; recording pyrometer; 1,000 lb. steam hammer; Arc welding equipment; one 18 to 20 in. pattern makers' lathe, with slide rest; one 16 to 18 in. disc sander; one Universal wood workers' vise; also two 14 in. x 5 ft. engine lathes.

Kan., Wichita—H. S. Hoeffien, 1516 North Waco Ave. (woodworker)—110 volt, 2 hp. motor, belting, rip saw, shafting, hangers and pulleys.

Ky., Lexington—Lexington Battery Mfg. Co., 416 West Short St.—machinery and equipment for proposed $75,000 plant, to replace that which was destroyed by fire.

La., New Orleans—R. C. Ostendorf, 1539 Canal St. (automobile repairing and paint shop)—welding outfit, paint removing machine and a small size electric drill (new or used).

La., Sterlington (Ouachita P. O.)—Imperial Oil & Gasoline Products Co.—machinery and equipment.

La., Sterlington (Ouachita P. O.)—Thermatomic Carbon Co., (manufacturer of carbon black and by products)—machinery and equipment for proposed addition to plant.

La., Windsor (Doss P. O.)—Texas-Louisiana Producing & Carbon Co.—machinery and equipment for plant for the manufacture of carbon black and similar products.

Me., South Sanford (Sanford P. O.)—Jagger Bros.—equipment for addition to spinning mill.

Md., Baltimore—D. C. Elphinstone, 408 Continental Bldg. (machinery)—crane, 75 ft. beam, electrically operated, capable of handling 2 yd. clamshell on 60 ft. radius; shovel, electrically operated, 3 yd. dipper, caterpillar or traction tread.

Md., Baltimore—Holtite Mfg. Co., Warner and Ostend Sts., (manufacturer of rubber heels, etc.), A. A. Esterson, Secy. and Treas.—40 in. mills.

Mass., Boston—Handschumacher & Co., 25 John St., (meat packers and wholesalers)—packing and cold storage machinery and equipment for proposed plant at 16 North St.

Mass., Boston—Knox & Morse Co., Inc., 140 Oliver St. (manufacturer of chemicals)—chemical manufacturing machinery of various kinds.

Mass., Boston—J. C. Santis, 149 Cummings St.—one automatic weighing machine and several 1 to 3 lb. packaging machines (used).

Mass., Millbury—S. E. Hull Co. (woolen mill, shoddy, etc.)—machinery for shoddy mill.

Mass., North Chelmsford—Lowell Textile Co., J. Reed, owner—woolen mill machinery.

Mass., Pittsfield — Clarknit Mills, Inc., (knitting mill), J. A. Clark, Treas.—machinery for mill.

Mich., Detroit—Chevrolet Motor Co., General Motors Bldg.—miscellaneous machine equipment for general automobile finishing, for proposed factory at Norwood, O.

Mo., Kansas City—The Lion Oil & Refining Co., 622 Finance Bldg., V. H. Smith, Secy.—10 or 12 complete Burton type oil stills, also a considerable amount of tankage.

N. H., Tilton—A. S. Brown Mfg. Co.—hosiery dyeing machine.

N. H., Tilton—E. W. Charland—textile machinery for small cotton and woolen goods manufacturing plant, including power cutting, sewing and stitching machines, etc.

N. J., Trenton—Castanea Dairy Co., 234 North Broad St.—machinery for proposed plant.

N. J., Trenton—F. A. Straus & Co., Johnson Ave. (manufacturer of worsted and silk yarns), W. Foster, 369 West State St., Gen. Mgr.—$150,000 worth of machinery for plant recently purchased.

N. Y., Alfred—C. D. Reynolds Co.—refrigeration and cold storage machinery and equipment to replace that which was recently destroyed by fire.

N. Y., Batavia—Gray Machine & Parts Corp. (manufacturer of wrenches)—machinery and equipment for large addition.

N. Y., Brockport—E. H. Norton and others—machinery for addition to plant for the manufacture of power spraying equipment.

N. Y., Buffalo—The Standard Milling Co., c/o A. E. Baxter, Engr., Ellicott Sq.—machinery and equipment for proposed flour mill, 30,000 bbl. daily capacity, on Outer Harbor.

N. Y., Buffalo — J. A. Walter Milling Co., Chamber of Commerce Bldg.—machinery and equipment for flour mill on Ohio St. and Erie Basin.

N. Y., Franklinville—Ontario Knife Co.—equipment for proposed addition to knife factory.

N. Y., Geneva—A. E. Meyers, 150 Castle St.—one crane and clamshell outfit, and one portable sand digger and loader.

N. Y., New York—McGowan & Connolly Co., 739 East 151st St., (marble)—lathe for turning stone column, 10 ft. long and 2 ft. diameter.

N. Y., New York—Natl. Biscuit Co., 85 9th Ave.—repair equipment for new shop on West 16th St.

N. Y., Rochester — Rapps Dry Cleaning Co., 398 South Ave.—complete mechanical equipment for $4,000 cleaning plant.

N. Y., Tonawanda—American Kardex Co., Main St. (manufacturer of Kardex filing system and equipment for offices)—machinery and equipment for proposed 2 story addition to factory on Main and Wheeler Sts.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Lead quoted in New York at 7½c. as against 7⅜c.; zinc, 7¾c. as compared with 7⅝c. per lb., last week. Prices higher in St. Louis. Improvement shown in copper inquiries. Advance of ¼c. in zinc sheets in New York and in brass rods in Cleveland; solder up 1c. per lb. in both cities. Cleveland warehouses also advanced babbitt metal 2c. and scrap lead ½c. per lb., during week. Linseed oil market trifle softer; but Chicago advances price 1c. per gal. Buying better in lubricants; prices firm. Demand steadier for lard oil; New York quotes 60c. as against 55c. per gal. Discounts reduced about 10 points on leather belting.

Declines—Maximum on blue annealed steel sheets down 10c.; black and galvanized, 25c. per 100 lb., f.o.b. Pittsburgh. Mill price of shapes, plates and bars firm at $2 per 100 lb. on ordinary tonnages; shading of $1@$2 per ton on large inquiries. Some of the more attractive tonnages on shapes, have been taken at $1.90, but special or undesirable plate business, quoted as high as $2.10@$2.15 per 100 lb. Electrolytic and scrap copper both down ½c. per lb. in New York warehouses. Connellsville coke reduced 50c. per ton; improvement in car supply.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$31.55
Northern Basic	33.27
Southern Ohio No. 2	33.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	35.80
BIRMINGHAM	
No. 2 Foundry	27.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	32.64
Virginia No. 2	37.17
Basic	31.75
Grey Forge	30.50
CHICAGO	
No. 2 Foundry local	32.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	33.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	31.77
Basic	31.77
Bessemer	33.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.75	4.19	3.70	4.00
No. 12	2.60@2.85	4.24	3.75	4.05
No. 14	2.70@2.90	4.29	3.80	4.10
No. 16	2.90@3.20	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized				
Nos. 10 and 11.	3.35@3.60	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.70	5.00	4.50	4.95
Nos. 17 and 21.	3.75@4.00	5.30	4.80	....
Nos. 22 and 24.	3.90@4.15	5.45	4.95	5.40
No. 26	4.05@4.30	5.60	5.10	5.55
No. 28	4.35@4.60	5.90	5.40	5.95

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
$\frac{1}{8}$	6.50		11@12
$\frac{5}{32}$ to $\frac{1}{4}$	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.25
Tin, 5-ton lots, New York	38.00
Lead (up to carlots), St. Louis	6.80@6.85; New York. 7.50
Zinc (up to carlots), St. Louis	7.20; New York. 7.75

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	20.70	23.00	20.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	8.00
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.50	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	12.00	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	4.75
Lead, tea	4.25	4.50	4.00
Brass, heavy	7.00	6.50	9.25
Brass, light	6.00	5.75	6.00
No. 1 yellow brass turnings	6.50	7.00	7.00
Zinc	3.00	4.00	4.25

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½	\$0.12	\$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville... per net ton		\$8.00	
Coke, prompt foundry, Connellsville... per net ton		10.00@12.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1½ and 1¾x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ½ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$6.00	\$3.50	\$3.50
Washers, cast iron, ¾ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ½-in., ¾-in., 1x2 in. to 5 in., per 100 lb. (net)	\$5.00	\$3.90	\$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.60	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets,			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

N. C., Concord—Locke Cotton Mills Co. (cotton mills)—several "Crompton & Knowles" looms, 30 in. 2-box style.

N. C., Stanley—Lola Gingham Mills, Inc. —machinery and equipment for proposed $250,000 mill for the manufacture of ginghams and cloth.

O., Akron—General Tire & Rubber Co.—additional machinery and equipment for proposed 3 unit plant.

O., Alliance—Amer. Steel Fdry. Co.—4,000 lb. steam forging hammer.

O., Canfield — Dispatch, (newspaper) — model No. 1 linotype (new or used).

O., Cleveland—Denby Wire & Iron Co., 5119 Euclid Ave. (manufacturer of wire railings, bank fixtures, etc.)—additional machinery and equipment for new 1 story plant at 3005 East 86th St.

O., Cleveland—H. M. Warner, Engr., Public Auditorium, Lakeside and East 6th Sts. —one floor sanding machine.

O., Cleveland—H. P. Whitworth, Archt., 526 Hickox Bldg.—one chain belt conveying machine.

O., Columbus—Arrow Sand Co., Hartman Bldg., S. Stephanian, Purch. Agt.—conveying machine for overhead storage on Grandview Rd.

O., Columbus — Col-O-Hi Battery Co., Dublin Ave., J. D. Saley, Purch. Agt.—wood and metal working machinery.

O., Columbus—Columbus Varnish Co., 264 Cozzens St., W. S. Hanna, Pres.—varnish making machinery (new), canning and labeling machinery for proposed addition to factory.

O., Columbus—Rainbow Tire & Rubber Co., 402 Southern Hotel, C. E. Ross, Pres.—mills, presses, curing machines for plant at Delaware.

O., Delaware—The Sunray Stove Co.—machinery and equipment for proposed addition to factory.

O., Fremont—Stull-Boylston Co. (manufacturer of pens and pencils)—machinery and equipment for proposed plant at Lima.

O., Leetonia—Fabricated Steel Products Co.—cupola fan, 30 or 36 in., belt driven (used preferred).

O., Middletown—The Journal—Mergenthaler linotype and other printing equipment.

O., Newark—Tucker Boiler Works Co.—machinery for the manufacture of steel tanks, also welding equipment.

O., Somerset—Belden Brick Co., G. Brand, Supt.—machinery and equipment for additions to brick manufacturing plant.

Okla., Oklahoma City—The New State Ice Co., 2 West 3rd St.—ice making machinery for new addition.

Okla., Stamps—Blackfoot Lumber Co.—machinery and equipment for proposed planing mill, to replace that which was destroyed by fire.

Ore., Portland—F. L. Evans, 412 Consolidated Security Bldg., (Industrial Engineer)—one to six 10 ton units for converting sawdust and wood waste into cattle feed, also to save the by products.

Ore., Portland—F. E. VanRank, 3212 68th St., S. E.—one universal woodworker with either band or scroll saw, lathe, shaper and planer, electrically driven.

Pa., Apollo—Apollo Steel Co., A. McCarthy, Purch. Agt.—two 15 ton cranes.

Pa., Catasauqua — Bryden Horse Shoe Co. (manufacturer of horse shoe calks)—machinery and equipment for new plant.

Pa., Coatesville—Lukens Steel Co.—machinery and equipment for 4 unit plant and warehouse at New Orleans, La.

Pa., Corry—The Corry Radiator Corp. —machinery and equipment for proposed foundry.

Pa., Irvine—National Forge & Tool Co.—forge and tool shop equipment.

Pa., Monessen—The Monessen Fdry. & Machine Co.—equipment for foundry to replace that which was destroyed by fire

Pa., Phila.—Arata Dye Wks., Front and Lombard Sts., J. B. Arata, Purch. Agt.—vats, dryers and other machinery for new dyeing plant.

Pa., Phila.—Breyer Ice Cream Co., 9th and Cumberland Sts.—ice manufacturing machines, mixers, cookers, wrapping and packing machines, conveyors, etc., for new plant.

Pa., Phila.—Elmwood Mills Co., 48 South Front St.—3 or 4 cylinder Garnett machines, 30 x 60 in.

Pa., Phila.—General Paper Products, 3430 Lancaster Ave., (manufacturer of paper and tin containers), G. L. Harnley, Purch. Agt.—creasing machines, dies and general metal and paper working machines.

Pa., Phila.—R. T. Moorehouse Paper Co., Bridge and Thompson Sts.—one power rotary coal and gravel screening plant.

Pa., Phila.—Mountain Valley Bottling Co., 1625 Water St., (manufacturer of beverages), R. R. Hogan, Purch. Agt.—automatic bottle washing and filling machinery.

Pa., Phila. — Winer Bakery, 60th and Osage Ave., J. Winer, Purch. Agt.—dough mixers, trays and furnaces for bakery.

Pa., Pittsburgh—Guibert Steel Co., Diamond Natl. Bank Bldg.—crane for new plant.

Pa., Pittsburgh—Mackintosh, Hemphill & Co., Engrs., foot of 12th St., A. Garrison, Fdry. Dept., Purch. Agt.—crane.

Pa., Wilkes-Barre — Diamond Drug Co., 116 East Northampton St., B. Miller, Dir. and Mgr.—machinery and equipment for the manufacture of a complete line of drugs, etc.

Pa., Williamsport—D. Updegraff & Co., Canal and Market Sts. — machinery and equipment for addition to monument works.

Pa., Windgap—A. F. Teel (slate mill)—grinding, cutting and finishing machinery.

Tex., Dallas—Print Shop, 2326 Live Oak St.—Chandler & Price power job printing press (used).

Tex., Fort Worth—The Printer, Box 845, —12 x 17 in. job press, paper cutter, wire stitcher, shafting, motor belting, hangers and pulleys.

Tex., Paris—The News, —job press, belting, hangers, shafting, pulleys and linotype.

Tex., Temple—J. J. Palmer—woodworking machinery, saws, belting, pulleys, hangers, bearings, shafting and sander.

Vt., Northfield — The Nautanna Worsted Co., Inc. (manufacturer of textiles)—equipment for carding room.

Va., Lynchburg — Lynchburg Fdry. Co., Peoples Natl. Bank Bldg.—pattern shop equipment.

Va., Richmond—The Wheeling Corrugating Co., 801 McDonough St.—machinery for proposed addition to factory for the manufacture of corrugated products.

W. Va., Clarksburg — Tygarts Valley Fuel Co., E. M. Prendergast, Dir.—machinery and equipment for extensive development of coal properties.

W. Va., Greenview—Greenview Coal Co., E. G. Watkins, Pres. and Mgr.—hoisting machinery and mining equipment.

W. Va., Parkersburg—Ideal Corrugated Box Co., Jeannette St.—corrugating machine.

Wis., Appleton — Kaukauna Quarry Co., c/o J. P. Frank, 803 College Ave—crushing machinery.

Wis., Chilton — A. A. Berger — sausage making, grinding and power machinery.

Wis., Crandon—The Vulcan Last Co.—power machinery for proposed shoe factory.

Wis., Fond du Lac—Combination Door & Screen Co., 180 Ruggles St.—woodworking machinery for proposed factory on Military St.

Wis., Green Bay—The Bond Pickle Co., Platten Bldg.—machinery for packing plant at Oconto.

Wis., La Crosse—Cameron Motor Car Co., 127 South 6th St.—gasoline storage tank with pump for proposed garage.

Wis., Madison—Capital Plating & Machine Co., 639 West Wilson St.—machinery and equipment for the manufacture of windshield spot lights, etc.

Wis., Madison — Madison Pattern Wks. Co., 2015 Winnebago St., W. J. Polk, Purch. Agt.—equipment for new pattern shop.

Wis., Manitowoc—Invincible Metal Furniture Co.—nickel plating machinery for the manufacture of vaults, safety deposit boxes, etc.

Wis., Menomonie—E. V. Johnson—repair machinery, gasoline storage tank, pump and air tank for garage to replace that which was destroyed by fire.

Wis., Milwaukee—J. J. Eckert, 701 56th St. (carpentry and millwork) — Universal woodworker.

Wis., Milwaukee—Federal Rug Cleaning Co., 914 Winnebago St.—cleaning equipment for proposed addition to factory.

Wis., Milwaukee—W. D. Mann, 204 Grand Ave. (machinist)—woodworking machinery (used).

Wis., Milwaukee—Wenzel & Henock Co., 498 27th St. (heating and plumbing)—unloading crane and belt driven air compressor.

Wis., Mosinee—The Mosinee Times, L. E. Osborne, Mgr.—machinery and equipment for addition to print shop.

Wis., Oshkosh—H. Thew, 52 State St. (woodwork)—band saw.

Wis., Rhinelander—S. Miller Cold Storage Co.—refrigerating and power machinery.

Wis., Rhinelander—The Northern Grain Co., O. C. Nelson, Mgr. — grinding and power machinery for proposed feed mill.

Wis., Rice Lake—Craftsman Job Printing Co.,—Gordon job printing press 14 x 22 in. for power equipment (used).

Wis., Stevens Point—The F. & G. Auto Parts Co., 425 Madison St.—air compressor, gasoline storage tank and pump for proposed $40,000 addition to garage.

Wis., Superior—Twin Ports Oil Co., J. E. Vgreslline, Mgr., — oil storage tanks and pumps for proposed filling station.

Wis., Suring—A. A. Baatz—equipment for new addition to blacksmith shop.

B. C., Vancouver—The False Creek Lumber Co., 6th Ave., W.—saw mill machinery for proposed mill.

Ont., Aylmer—J. L. Thayer & Son—complete equipment for proposed $40,000 garage and automobile repair shop.

Ont., Camperdown — Canada Oil & Gas Co., Ltd.—equipment for drilling.

Ont., Chatham—R. Baxter—equipment for saw mill, to replace that which was destroyed by fire.

Ont., Elmira—The Elmira Co-operative Creamery—equipment for proposed addition to creamery.

Ont., Toronto—Toronto Electric Comrs., Yonge and Shuter Sts.—receiving bids until Nov. 23 for overhead cranes.

Metal Working Shops

Calif., Emeryville — The Great Western Meter Co., 5701 South San Pablo Ave., Piedmont, awarded the contract for the construction of a 1 and 2 story factory, here. Estimated cost $26,850. Noted Nov. 9.

Calif., Oakland—J. E. French Co., 124 Grand Ave., awarded the contract for the construction of a 1 story automobile sales room and service garage on S. E. Bway. and Moss Ave. Estimated cost $65,000.

Calif., Oakland—N. S. Sacks, c/o H. J. Christensen, Contr., Federal Bldg., awarded the contract for the construction of a 1 story automobile school shop on 12th St. near Jackson St. Estimated cost $17,000.

Calif., Oakland—The United States Light & Heat Corp., 5432 East 14th St. is having plans prepared for the construction of the first unit of its manufacturing plant, 1 story, 134 x 160 ft., on 98th Ave. Estimated cost $50,000. Architect not announced.

Calif., Sacramento—The Latourette-Fical Co., 307 Front St., plumbing and heating contractors, awarded the contract for the construction of a shop building. Estimated cost $17,272. Noted Nov. 9.

Calif., San Francisco—L. R. Lurie, Mills Bldg., is having plans prepared for the construction of a 2 story, 62 x 137 ft. garage on Sacramento St. near Polk St. Estimated cost $54,000. A. S. Bugbee, 26 Montgomery St., Archt.

Calif., San Francisco—A. E. Perley, 240 Duboce Ave., awarded the contract for the construction of a 1 story, 60 x 75 ft. garage on 14th St. near Mission St. Estimated cost $75,000.

Conn., Fairfield—S. Lowe & Sons Co., 30 Sunfield Ave., is receiving bids for the construction of a 2 story, 45 x 80 ft. addition to its hardware factory. Estimated cost $25,000.

Conn., Rockyhill—The Connecticut Fdry. Co. awarded the contract for the construction of a 2 story, 30 x 70 ft. addition to its plant. Estimated cost $25,000.

Conn., Shelton—The International Silver Co., 48 State St., Meriden, awarded the contract for the construction of a 1 story, 30 x 40 ft. addition to its plant on River St., here. Estimated cost $25,000.

D. C. Washington—The Evening Star Newspaper Co., 11th St. and Pennsylvania Ave., awarded the contract for the construction of a 5 story paper warehouse and garage, to contain 12,000 sq. ft. of floor space, on Canal St. near 2nd St.

Ill., Chicago—T. R. Bishop, Archt., 35 South Dearborn St., is receiving bids for the construction of a 1 story, 100 x 220 ft. addition to garage for Reba Bros., 4728 Bway. Estimated cost $60,000.

Kan., Winfield—Stuber Bros. are having plans prepared for the construction of a 1 story, 100 x 140 ft. Ford service and sales station. Estimated cost $50,000. L. Schmidt & Co., 121 North Market St., Wichita Archts.

Mass., Holyoke—The Bd. Pub. Wks., City Hall, plans to build a 1 story garage and service station. Estimated cost $80,000.

Mass., Peabody—D. Bertholdi, c/o G. A. Cornet, Archt., 10 Central Ave., Lynn, is having plans prepared for the construction of a 1 story, 45 x 130 ft. machine shop on Wilson Sq., here. Estimated cost $25,000.

Mass., Springfield—The Facto Motor Trucks, Inc., 296 Pecousic Ave., will build a 2 story, 80 x 105 ft. factory. Estimated cost $35,000.

Mass., Springfield—The Spartan Saw Wks., 41 Taylor St., awarded the contract for the construction of a 1 story, 42 x 100 ft. saw factory on Fisk Ave. Estimated cost $20,000.

Mass., West Springfield—The New England Smelting Wks., Union St., plans to build a 1 story factory. Cost between $15,000 and $25,000.

Mass., Worcester—The Parker Wire Goods Co., 18 Grafton St., plans to build a 1 story addition to its wire goods plant, to contain 30,000 sq. ft. of floor space, on Washington St. Estimated cost $75,000. Architect to be announced later.

Mich., Hancock—The Bd. Educ. will receive bids about Dec. 1 for the construction of a 3 story, 80 x 336 ft. school building, including forge, foundry, sheet metal and woodworking departments and automobile mechanics' shop. Estimated cost $300,000. G. L. Lockhart, 1353 University Ave., St. Paul, Minn., Archt.

N. Y., Brooklyn—The St. Marks Realty Co., c/o S. J. Kessler, Engr. and Archt., 529 Courtland Ave., New York, will build a 2 story, 75 x 130 ft. garage, here. Estimated cost $75,000.

N. Y., Buffalo—The Eberhardt Steel Products Co., Chelsa St., plans to build an addition to its mill. Estimated cost $5,000. Architect not announced.

N. Y., Frankliaville—The Ontario Knife Co. plans to build an addition to its knife factory. Cost will exceed $5,000. Architect not announced.

N. Y., New York—The Atwell Contg. Co., c/o G. G. Miller, Engr. and Archt., 1482 Bway, will build a 1 story, 120 x 230 ft. garage on Jerome Ave. and 192nd St. Estimated cost $50,000.

N. Y., New York—The Harmon Realty Co., Inc., c/o Springsteen & Goldhammer, Engrs. and Archts., 32 Union Sq., will build a 1 story, 100 x 100 ft. garage on Freeman St. Estimated cost $30,000.

N. Y., New York—The Natl. Biscuit Co., 85 9th Ave., will soon receive bids for the construction of a 3 story garage and repair shop at 407 West 16th St. Estimated cost $65,000. J. R. Terrance, 85 9th Ave., Engr. and Archt.

O., Cleveland—The Brough Co., 3823 St. Clair Ave., bottlers, receiving bids for the construction of a 1 story, 40 x 70 ft. store building and a 1 story, 52 x 80 ft. garage on East 72nd St. and St. Clair Ave. Estimated cost $50,000. E. Brough, Mgr. J. Brugnone, 3505 Woodlawn Ave., Archt. Noted Nov. 9.

O., Cleveland—C. C. Deming, 2517 Edgehill Rd., Cleveland Heights, plans to build a 2 story, 60 x 80 ft. garage and commercial building at 3120 Carnegie Ave., here. Estimated cost $40,000. Private plans.

O., Cleveland—The International Harvester Co., Harvester Bldg., Chicago, plans to build a 10 story warehouse and service station, on East 55th St. and Julia Ave., here. Estimated cost $300,000. A. Price, c/o owner, Archt.

O., Cleveland—The Willard Storage Battery Co., 246 East 131st St., will build a 1 story, 15 x 300 ft. addition to its factory. Estimated cost $40,000.

O., Delaware—The Sunray Stove Co. plans to build a 60 x 100 ft. addition to its factory.

O., Norwood—A. Kahn, Archt., 1000 Marquette Bldg., Detroit, is receiving bids and will open same about Nov. 20 for the construction of a 2 story, 320 x 500 ft. automobile factory on Smith Rd., here, for the Chevrolet Motor Co., General Motors Bldg., Detroit.

O., Ravenna—The Phillips Body Co., c/o Fisher Body Ohio Co., Cass St. and Blvd., Detroit, have had plans prepared for the construction of a 1 story, 40 x 100 ft. addition to its factory, here. Estimated cost $40,000. Carter-Richards Co., 923 Illuminating Bldg., Cleveland, O., Archts.

Ore., Portland—The Skyline Corp., 801 Pittock Bldg., plans the construction of a 10 story and 2 story basement, and 200 x 200 ft. office building, basement to contain heating, power and light plants, also a 500 auto garage, on 5th, 6th, Taylor and Salmon Sts. Estimated cost, $2,500,000. J. C. Gibson, Pres. Architect not selected.

Pa., Corry—The Corry Radiator Corp. awarded the contract for the construction of a 1 story, 120 x 150 ft. foundry at its radiator works.

Pa., Nanticoke—The Nanticoke Garage Co. is having plans prepared for the construction of a 3 story, 46 x 100 ft. garage, with a wing 84 ft. long, on Spring St. Estimated cost $65,000. G. T. Price, 409 Miller Bldg., Scranton, Archt.

Pa., Monessen—The Monessen Fdry. & Machine Co. plans to rebuild the portion of its shop which was destroyed by fire. Estimated cost $150,000. Architect not announced.

Pa., Newport—The Mineral Products Co. plans to rebuild its plant, which was recently destroyed by fire. Loss $25,000. J. R. Morgan, proprietor.

Pa., Phila.—L. J. Kolb, 10th and Reed Sts., awarded the contract for the construction of a 1 story 175 x 200 ft. garage at 1433 Parrish St. Estimated cost $44,000.

Pa., Pittsburgh—The Mack International Motor Truck Corp., 5911 Center Ave., awarded the contract for the construction of a 1 story, 120 x 280 ft. garage, sales and service station on Liberty and Gross Sts. Estimated cost $60,000.

Pa., Pittsburgh—The Studebaker Sales Co., 4724 Baum Blvd., is having plans prepared for the construction of a 2 story, 80 x 100 ft. addition to its garage and sales building. Estimated cost $40,000. G. H. Schwan, Peoples Bank Bldg., Archt.

Pa., Scranton—T. F. Leonard Estate, 505 Lackawanna Ave., awarded the contract for the construction of a 2 story, 80 x 130 ft. garage on Adams St. Noted Oct. 5.

Pa., Washington—H. Robinson plans to build a 3 story, 65 x 102 ft. garage on Chestnut St. Estimated cost $40,000. Architect not selected.

Pa., Waynesburg—T. Cochran, Dawson, is having plans prepared for the construction of a 2 story, 70 x 90 ft. garage, here. Estimated cost $40,000. H. W. Altman, Fayette Title & Trust Bldg., Uniontown, Pa., Archt.

R. I., Providence—Goldberger & Steiner, Olneyville Sq., are having plans prepared for the construction of a 1 story garage on Library Court. Estimated cost $40,000. G. Wolf, 88 Althea St., Archt.

Wis., Chippewa Falls—The Chippewa Valley Auto Co., 16 River St., awarded the contract for the construction of a 2 story, 124 x 130 ft. garage. Estimated cost $75,000. Noted Oct. 26.

Wis., LaCrosse—The Bergh Auto Co., 207 South 4th St., awarded the contract for the construction of a 1 story, 60 x 171 ft. garage on King St. Estimated cost $40,000.

Wis., La Crosse—O. A. Merman, Archt., 210 Linker Bldg., is receiving bids and will open same about Nov. 13 for the construction of a 1 story, 60 x 146 ft. garage on 6th and State Sts. for the Cameron Motor Car Co., 127 South 6th St. Estimated cost $40,000.

Wis., Marinette—C. Anderson & Sons Co., Cook and Merryman Sts., will build a 2 story, 50 x 75 ft. factory and machine shop on Main St. Estimated cost $75,000. Noted Oct. 19.

Wis., Menomonie—E. V. Johnson plans to build a 1 story, 58 x 176 ft. garage on Main St., to replace the one which was destroyed by fire. Estimated cost $40,000. Architect not selected.

Wis., Milwaukee—The Luick Ice Cream Co., 183 Ogden Ave., awarded the contract for the construction of a 1 story, 120 x 120 ft. garage on Van Buren St. Estimated cost $75,000. Noted Oct. 26.

Wis., Racine—The F. J. Greene Eng. Wks., 1028 Douglas Ave., awarded the contract for the construction of a 1 story, 70 x 125 ft. addition to factory. Estimated cost $15,000.

Wis., Racine—The F. J. Greene Eng. Wks., 1028 Douglas Ave., will soon receive bids for the construction of a 3 story, 53 x 100 ft. factory. Estimated cost $50,000. E. B. Funston Co., Janes Bldg., Archt. Noted Oct. 12.

Wis., Stevens Point—The F. & G. Auto Parts Co., 425 Madison St., is receiving bids for the construction of a 1 story, 35 x 102 ft. addition to its garage. Estimated cost $40,000. Private plans.

Ont., Aylmer—J. L. Thayer & Son plan to build a garage and automobile repair shop. Estimated cost $40,000.

Ont., Hamilton—The Abrasive Co. of Canada, Ltd., 858 Burlington St., awarded the contract for the construction of a 1 story, 40 x 60 ft. furnace building. Estimated cost $15,000.

Ont., Toronto—The Toronto Motor Car Ltd., 52 James St., plans to build a 3 or 4 story garage and sales room on Jarvis St. Estimated cost $100,000. L. E. Dowling, 167 Yonge St., Archt.

General Manufacturing

Calif., Dinuba—The Central California Ice Co., P and Mono Sts., Fresno, plans to build an ice plant on South M and Ventura Sts., here.

Calif., Emeryville—The Amer. Rubber Co., Park Ave. and Watt St., Oakland, awarded the contract for the construction of a 1 story factory on Emery and Park Sts., here. Estimated cost $25,000.

Calif., Livermore—The Livermore Soda Wks. has purchased a site on Lizzie St. and plans to build a soda water plant. G. F. Tubbs, owner.

Calif., Marysville—The Chamber of Commerce plans to build dehydrators for growers in Yuba county.

Calif., Marysville—Swift Bros., 2nd and E Sts., plan to build a planing mill on 3rd St.

Calif., Merced—The California Packing Corp., 101 California St., San Francisco, has had preliminary plans prepared for the construction of several large cannery buildings on 23rd St. from P to R Sts. and 22nd St. between Q and R Sts. P. L. Bush, 101 California St., San Francisco, Engr. and Archt.

Calif., Oakland—The California Packing Corp., 101 California St. San Francisco, is having plans prepared for the construction of a cannery on 1st and Filbert Sts., here. P. L. Bush, 101 California St., San Francisco, Archt.

Calif., Oakland—The East Bay Creamery Co., 18th St. and San Pablo Ave., awarded the contract for the construction of a 1 story creamery on N.E. 22nd and Market Sts. Estimated cost $24,000.

Calif., San Francisco—The Anderson Bros. Planing Mill Co., 2399 Powell St., will build a 2 story, 70 x 50 ft. planing mill on Quint St. between Burke and Custer Aves. Estimated cost $15,000.

Calif., San Francisco—The Banner Refining Co., Kohl Bldg., is having plans prepared for the construction of a refining plant, consisting of 2 buildings, oil storage tanks, etc., on Islais Creek. Estimated cost $84,000. F. G. White, Ferry Bldg., Engr.

Calif., San Francisco—The General Mfg. Co., Pacific Bldg., has had plans prepared for the construction of a 1 story box factory on San Bruno Ave. Estimated cost $40,000. W. W. Hanscom, 848 Clayton St., Archt.

Calif., San Francisco—The San Francisco Sulphur Co., 624 California St., awarded the contract for the construction of a sulphur refinery on North Point St. Estimated cost $35,000.

Conn., Harford—The Frisbie Pie Co., 363 Kossuth St., Bridgeport, awarded the contract for the construction of a 2 story, 90 x 100 ft. bakery and garage on Broad St., here. Cost between $50,000 and $60,000. Noted Oct. 26.

Conn., New Haven—The Ward Baking Co., Southern Blvd. and St. Marys St., New York City, plans to build a 2 story bakery on Lombard St., here. Architect not announced.

Conn., Waterbury—The Hamilton Bottling Wks., Burton St., awarded the contract for the construction of a 1 and 2 story, 30 x 70 ft. bottling plant. Estimated cost $15,000.

D. C., Wash.—The Corby Baking Co., 2301 Georgia Ave., N. W., awarded the contract for the construction of an addition to its bakery.

Fla., Daytona Beach—The Peninsular Ice & Cold Storage Co. will open bids about Dec. 1 for the construction of a 1 story ice manufacturing and cold storage plant. G. G. Bailey, Pres.

Ga., Athens—The National Roofing Co., Fillmore St., Tonawanda, N. Y., plans to build a branch factory for the manufacture of roofing products, here. Estimated cost $600,000.

Ill., Chicago—The Bassick Mfg. Co., 2638 North Crawford Ave., awarded the contract for the construction of a 1 story, 55 x 142 ft. factory for the manufacture of automobile accessories. Estimated cost $30,000. Noted Oct. 19.

Ill., Chicago—Dubin & Eisenberg, Archts., 14 West Washington Sts., are receiving bids for alterations and the construction of a 3 story, 75 x 98 ft. addition to factory at 1006-1010 West Maxwell St. for the Kosher Star Sausage Mfg. Co. Estimated cost $75,000.

Ill., Chicago—The Natl. Paint & Wall Paper Co., c/o C. Hatzfeld, Archt., 7 South Dearborn St., awarded the contract for the construction of a 1 story, 47 x 105 ft. factory at 4317 Grand Ave. Estimated cost $20,000. Noted Sept. 21.

Ill., Chicago—The X. L. Refrigerating Co., 1834 West 59th St., is receiving bids for the construction of a 1 story, 125 x 132 ft. factory on 59th and Aberdeen Sts. Estimated cost $60,000. A. G. Lund, 453 West 63rd St., Archt.

Ind., Lafayette—The National Refining Co., Kossuth St., plans to rebuild a portion of its oil refinery which was recently destroyed by fire. Estimated cost $100,000.

Kan., Atchison—The Blair Milling Co., 300 South 4th St., awarded the contract for the construction of a 6 story, 36 x 83 ft. plant, storage capacity 50,000 bu. Noted Oct. 5.

La., La Faayette—The La Fayette Sugar Refining Co. plans to rebuild its refinery which was recently destroyed by fire. Estimated cost $300,000. Architeect not announced.

La., Sterlington (Ouachita P. O.)—The Imperial Oil & Gasoline Products Co., plans to build large additions to oil refinery and gasoline works. Estimated cost $150,000.

Mass., Brighton (Boston P. O.)—The Boston Spun Silk Co., Western Ave., awarded the contract for the construction of a 2 story weave shed addition to its plant. Estimated cost $40,000.

Mass., Brighton (Boston P. O.) — The Market Paper Box Co., 132 Market St., will build a 2 story paper box factory on Western Ave. Estimated cost $20,000.

Mass., Brockton—The Lapworth Webbing Co., Sumner St., plans to build a 2 story webbing factory on South and Crescent Sts. Archts. not announced.

Mass., Holyoke—The Massachusetts Baking Co., Commercial St., awarded the contract for the construction of a 2 story, 75 x 100 ft. bakery, including ovens, garage, etc. Cost between $16,000 and $18,000.

Mass., Westfield—A. E. and L. O. Peck, Holcomb St., will build a 1 story, 75 x 160 ft. woodworking factory on Silver St. Estimated cost $30,000.

Mass., West Roxbury (Boston P. O.)—The Armstrong Knitting Mill, 2011 Centre St., awarded the contract for the construction of a 2 story addition to its factory. Estimated cost $10,000.

Mass., Worcester—Woodbury & Co., Inc., 274 Main St., (engravers and printers), will build a 2 story, 100 x 100 ft. factory on West Boylston St. Estimated cost $28,-000. Private plans.

Mich., Kalamazoo—The Kalamazoo Paper Box Co., Kalamazoo and Pitcher Sts., plans to build a 3 story factory, to contain 15,-000 sq.ft. of floor space, on North Pitcher St. Estimated cost $200,000. Architect not selected.

Minn., Minneapolis—The Lavoris Chemical Co., 52 Western Ave., awarded the contract for the construction of a 3 story, 45 x 110 x 143 ft. office and factory building on 3rd St. and 10th Ave., N. Estimated cost $125,000. W. H. Levings, Secy. Noted Oct. 12.

N. J., Camden—The Camden Pottery Co., Mt. Vernon and Orchard Sts., awarded the contract for the construction of a 2 story, 65 x 140 ft. casting shop, containing 2 kilns. Estimated cost $55,000.

N. J., Linden—H. B. Hardenburg & Co., Inc., manufacturer of novelties, awarded the contract for the construction of a 1 story, 171 x 171 ft. factory with miscellaneous buildings, including garage.

N. J., Newark—Dugan Bros., 287 Bway., Brooklyn, N. Y., are having plans prepared for the construction of a bakery on Abington Ave. and 3rd St., here. Estimated cost $200,000. M. N. Shoemaker, 15 Central Ave., Engr. and Archt.

N. J., Trenton—The Castanea Dairy Co., 234 North Broad St., plans to build a 3 story, 80 x 80 ft. plant. Estimated cost $100,000. W. A. Klemann, 1st Natl. Bank, Archt.

N. J., Trenton—The Enterprise Tire & Rubber Co., North Clinton Ave., plans to build a rubber factory. Estimated cost $6,000.

N. J., Trenton—The Jointless Fire Brick Co., 1130 Clay St., Chicago, plans to build a 1 story, 72 x 250 ft. brick manufacturing plant on New York Ave., here. Estimated cost $75,000.

N. Y., Auburn—Lockwood, Greene & Co., Engrs., 101 Park Ave., New York City, will soon receive bids for the construction of a weave shed, machine shop and additions to dyehouse and power plant, for the Firth Carpet Co., 62 South Division St., here. Estimated cost $140,000.

N. Y., Binghamton—The Link Piano Co., Water St. awarded the contract for altering and building an addition to its factory. Estimated cost $8,000.

N. Y., Buffalo—The Standard Milling Co., c/o A. E. Baxter, Engr., Ellicott Sq., is having plans prepared for the construction of a large flour mill, capacity 30,000 bbl. per day, on Outer Harbor.

N. Y., East Aurora—W. Zapf plans to rebuild the portion of lumber mill which was destroyed by fire. Estimated cost $45,-000. Archt. not announced.

N. Y., Jamestown—Lockwood, Greene & Co., Engrs., Hanna Bldg., Cleveland, O., will soon receive bids for the construction of a 4 story, 75 x 175 ft. combing and spinning mill, here, for the Jamestown Worsted Mills, 335 Harrison St., manufacturer of men's and women's wear.

New York—The Iroquois Natural Gas Co., Iroquois Bldg., Buffalo, plans to build natural gas plants in Hanover, Arkport, Perrysburg and Gowanda.

N. Y., New York—The Reid Ice Cream Co., 79 West 132nd St., awarded the contract for the construction of a 2 and 3 story, 90 x 200 ft. factory, also a 30 x 55 x 200 ft. shed, west of 5th Ave. from 141st to 142nd Sts.

N. Y., New York—The H. Stern Lumber Co., c/o W. H. Gompert, Engr. and Archt., 171 Madison Ave., will soon receive bids for the construction of a lumber plant on 69th St. near Ave. A. Estimated cost $100,000.

N. Y., Niagara Falls — The Acheson Graphite Co., Buffalo Ave., plans to build an addition to its graphite factory. Estimated cost $5,000. Architect not announced.

N. Y., Rochester—The Newman Bros. Grain Co., 204 Troup St., awarded the contract for the construction of a 1 and 2 story addition to its grain mill, to contain 8,000 sq.ft. of floor space. Estimated cost $25,000. Noted Nov. 2.

N. Y., Rochester—The Powertown Tire Corp., 253 East Ave., is receiving bids for the construction of a 4 story, 40 x 60 ft. addition to its service works. Estimated cost $50,000. Hutchinson & Strutz, Cutler Bldg., Archts. Noted Aug. 10.

N. C., Elizabeth City—The Crystal Ice Co. is having plans prepared for the construction of a 1 story ice manufacturing plant. Estimated cost $100,000. Ophuls & Hill, 112 West 42nd St., New York City, Engrs. and Archts.

O., Akron—The General Tire & Rubber Co. has had plans prepared for the construction of a 1 and 3 story, 40 x 180 ft. and 60 x 100 ft. additions to its factory. Estimated cost $100,000. Osborn Eng. Co., Prospect Ave., Cleveland, Engrs. and Archts.

O., Cleveland—The Double Eagle Bottling Co., 6517 St. Clair Ave., is receiving bids and will open same about Nov. 17 for the construction of a 2 story, 30 x 60 ft. bottling factory. Estimated cost $40,000. J. Potokar, Mgr. F. J. Coghlan, 1782 Alcoy Rd., Archt.

O., Columbus—R. H. Erlenbusch Sons Co., 456 South High St., has had plans prepared for the construction of a 1 story, 32 x 52 ft. ice cream factory, including special refrigerating plant, on East Livingston Ave. Estimated cost $6,500. C. W. Bellows, 69 Ruggery Bldg., Archt.

O., Conneaut—The North Eastern Oil & Gas Co., plans to build an artificial gas plant in several units, capacity 2,000,000 cu.ft. per day. A process will be used, whereby natural and artificial gas can be mixed. F. B. Dunn, Pres.

O., Delaware—The Dept. Public Welfare, Oak and 9th Sts., Columbus, has had plans prepared for the construction of a 60 x 80 ft. power house, laundry building with wings each 30 x 90 ft., water plant, small pumping station, etc., at the Girls' Industrial Home, here. Estimated cost $125,000. W. H. Duffy, Dir.

O., Delaware—The Rainbow Tire & Rubber Co., 402 Southern Hotel, Columbus, manufacturer of tubes, is building a 100 x 300 ft. plant, here. C. E. Ross, Pres.

O., Warren—The Wadsworth Feed Co. plans to rebuild its 5 story flour mill and warehouse which was destroyed by fire. Estimated cost $100,000. J. X. Wadsworth, Pres.

Okla., Oklahoma City—The New State Ice Co., 2 West 3rd St., will build an ice plant. Estimated cost $250,000.

Okla., Stamps — The Blackfoot Lumber Co. plans to rebuild its planing mill which was recently destroyed by fire. Estimated cost $60,000. Architect not announced.

Pa., Catasauqua—The Bryden Horse Shoe Co. awarded the contract for the construction of a 1 story, 60 x 198 ft. factory for the manufacture of horse shoe calks.

Pa., Corry—The Corry-Jamestown Furniture Co. awarded the contract for the construction of a 1 story addition to its furniture factory. Estimated cost $5,000.

Pa., Glassmere — The Allegheny Plate Glass Co. awarded the contract for the construction of a 1 story, 50 x 600 ft. cast house for glass factory. Estimated cost $100,000.

Pa., Jacobs Creek—The United States of America Drug & Chemical Co. awarded the contract for the construction of a 2 story, 50 x 100 ft. chemical factory. Estimated cost $35,000. Noted Oct. 19.

Pa., New Castle—The Grasselli Powder Co., Guardian Bldg., Cleveland, O., will build a 1 story addition to its factory, consisting of six buildings, here.

Pa., New Castle—The New Castle News awarded the contract for the construction of a 2 story, 30 x 160 ft. printing plant. Estimated cost $75,000.

Pa., Phila.—The Amer. Ice Co., 6th and Arch Sts., and C. L. Weir, Engr., 41 East 42nd St., New York City, are receiving bids for the construction of a 2 story, 61 x 80 ft. and a 1 story, 21 x 80 ft. ice manufacturing plant on Duncannon and Mascher Sts.

Pa., Phila.—Ballinger Co., Archts., 12th and Chestnut Sts., will soon receive bids for the construction of a 2 story 74 x 194 ft. and a 1 story 141 x 193 ft. printing plant on 56th and Chestnut Sts., for the Chilton Publishing Co., 49th and Market Sts. Estimated cost $50,000.

Pa., Phila.—The Globe Ticket Co., 110 North 12th St., awarded the contract for the construction of a 9 story, 58 x 188 ft. and 34 x 47 ft. printing plant at 112-122 North 12th St.

Pa., Phila.—The United Gas Improvement Co., Broad and Arch Sts., plans to build a 2 story, 34 x 110 ft. fuel bins, consisting of conveyors system, also loading and unloading machinery. Estimated cost $115,000. Private plans.

Pa., Pittsburgh—The F. J. Kress Box Co., 3030 Liberty Ave., will soon award the contract for the construction of a 3 story, 70 x 155 ft. addition to its box factory. Estimated cost $40,000. T. Pringle, 504 Pittsburgh Life Bldg., Archt.

Pa., Pittsburgh—The Ward Baking Co., South Bend and St. Marys Sts., plans to build a bakery on Ridge Ave. Estimated cost $1,500,000. Private plans.

R. I., Woonsocket—The Macrodi Fibre Co., Carnation St., awarded the contract for the construction of a 1 story, 60 x 150 ft. textile factory. Estimated cost $40,000.

Tex., Dallas—The Trinity Paper Mills, Dallas County State Bk. Bldg., will receive bids until Jan., 1923, for the construction of a paper mill, capacity 30 tons per day. Estimated cost $500,000.

Tex., Texas City — The U. S. Gasoline Corp. is having plans prepared for the construction of a 4 unit Knox process cracking plant, capacity 100,000 gal. per day. Estimated cost $250,000. Company Engrs. and Archts.

Wis., Janesville — The Parker Pen Co., Court and Division Sts., plans to build a 2 story, 60 x 150 ft. factory on South Bluff St. for the manufacture of fountain pens. Estimated cost $50,000. Architect not selected.

Wis., Milwaukee—The A. C. Beck Co., 1 East St., manufacturer of boxes, awarded the contract for the construction of a 2 story, 60 x 135 ft. factory, to replace the one which was destroyed by fire. Noted Oct. 12.

Wis., Milwaukee—J. Wilging & Co., 1612 Teutonia Ave., building contractors, are receiving bids for the construction of a 2 story, 80 x 120 ft. millworking factory on Burleigh St. Estimated cost $45,000. Private plans.

Wis., Walworth—The Walworth Condensed Milk Co. will build a 1 story 14 x 60 ft. addition to its condensery, and a 24 x 44 ft. engine room. Estimated cost $20,-000.

B. C., Nordin—The J. Buckley Estate plans to rebuild its saw mill which was destroyed by fire. Estimated cost $100,000.

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The Manufacture of Rollers for Rubber Mangles

Problems Met by an English Shop in Turning, Grinding and Grooving Cylinders —Changing from Low to High Production—Single Purpose Machines

BY ALBERT CLEGG

ON NEARLY all the leading rubber plantations throughout the world the crude rubber is put through a preliminary mangling operation for the purpose of removing some of the foreign matter with which it is inevitably mixed and also for the purpose of rolling the substance into more easily transportable form. Much of this work is done on hand machines similar in every way, and no more elaborate than the common domestic mangle. In most cases, however, the rollers of the machine are of metal instead of the wooden ones of the household article. Often the rolls are of mild steel and electro-plated, so as to prevent rusting, but more usually they are of cast iron.

During the four or six months preceding the rubber harvest there is, in normal times, quite a brisk demand for this class of machinery and, since it is of the very roughest description, the price being commensurate with the crudity of finish, it lends itself very readily to quick methods of production. As regards the machine itself, the work is largely foundry work, little or no machining being done. The rollers, however, are another story. While no very great accuracy is required, the production of the rollers in the bulk offers some interesting problems in machine operation, more particularly when the comparatively low price is taken into account. If the job is properly tooled up for all its operations a good margin is possible in spite of the leanness of the selling price. Without this special consideration, it does not appear possible to avoid a loss.

Design of the Rollers

The rollers vary somewhat in both diameter and length but the most generally used size is 4 in. diameter, 20 in. long, the design being on the lines shown in Fig. 1. In many cases the rollers were ordered with helical grooves cut therein. These grooves formed a diamond pattern in the sheets of rubber, this pattern being a means of identification of the rubber from different plantations and also a means whereby the air was better able to circulate through the mass of material. In most cases the rollers were cut with a right hand and also a left hand helix, this being known as "diamond" cut, as distinct from the "spiral" cut of the single hand helix.

It should be stated that this job had drifted into the shop where the methods to be described were subsequently originated, the first orders consisting of so small a number of machines that any special methods of production were not at that particular time practicable. The orders, however, continued to come along in larger and larger batches until they were being received several times faster than the finished machines were being despatched. It became necessary, therefore, in sheer self-defence, to devise some quicker methods of dealing with the job. In the early days the spiral and diamond grooves had been cut in the lathe, and since most of them were 3½ in. or more lead with anything up to twenty starts, the rate of production will be better imagined than described. It was a slow process, consisting largely of racking back the lathe saddle for the next cut, and however hard a man might work, he had very little to show, except backache and a very ragged temper, for his efforts.

Molding

Quoting from memory the time taken to cut eighteen right and left hand grooves in a 4-in.x20-in. cast iron roller would be about six hours and the operator had no time to waste if he kept up this rate. The lathe, by the way, on which the job was done had been rigged up with the drive directly on the lead screw so that the change gears would be subjected to as little strain as possible. The machine, of course, thus drove backward, i.e. the lead screw drove the headstock spindle instead of the more usual procedure of the spindle driving the screw.

As stated, however, the outstanding orders began to bulk larger and larger, until there was about five years' work in at the then rate of production. There would be in the neighborhood of 10,000 rollers on order when it was decided that the job could be taken as a staple business, which would warrant a moderate outlay on improved methods of production.

The first consideration was the speeding up of the foundry; this consisted, in the main, of putting more men onto the job and the provision of more patterns and boxes. As will be seen from the sketch in Fig. 1, the roller was cored, with a vent pipe leading out at the side. The arbor is a square wrought iron bar, swaged down round at the ends and cast in the roller. The core was of oil sand and no attempt was made to remove it. The vent pipe was simply driven into the roller, which was then stacked on end so that any core sand that might come out had the opportunity of so doing. Otherwise the core remained in.

One little thing that helped considerably to increase foundry output on this job was the addition of a small amount of ferro-titanium to the molten metal immediately before pouring. This reduced the number of wasters due to blown holes very considerably. Prior to this and probably due to the fact that the rollers were poured on their side there had been a considerable loss. Another little idea which helped considerably to swell the proportion of good castings was the provision of a

narrow fin, about $\frac{1}{4}$ in. thick along the top of the casting. This received all the scum and other impurities and was readily broken off when the casting was being dressed. Another important factor in the increasing of the foundry output was the inauguration of a generous piece-work scheme, by means of which the moulders were able to earn nearly double pay by putting their backs into the job. Even with this rather unusual rate the cost of the castings was considerably less than under the old, leisurely, day-wage regime. Since it was output that was the principal factor and not the weekly earnings of the men, the scale of payments adopted was well worth while and justified by results.

As previously stated, the arbors were made from square-section wrought iron, the ends being forged round in a Ryder forging machine. The center holes were punched after the round ends had been forged, these holes being subsequently reamed out by a square center.

Turning Operations

At the outset the turning of the rollers was an every-day sort of a lathe job, the castings being handed over to a lathe operator who proceeded to center, square the ends of the arbor, rough and finish turn the roller and generally proceed in the manner common to any other casual type of turning job. The time taken would be about three to four hours for the 4-in. rollers with a proportionately longer time for the larger ones. Since an output of at least one hundred rollers a week was required and the turning department could not possibly put more men onto the job, it was decided to sub-divide the operations as far as possible and arrange for girls to do the work.

These operations eventually were classified as follows:

(1) Center and face arbors.
(2) Turn arbors.
(3) Rough turn outside of roller.
(4) Face ends of roller and square out corners.
(5) Diamond or spiral groove if required.
(6) Grind both ends of arbors.
(7) Grind outside of roller—clean up only.

The centering operation was done on a centering machine before the arbors were cast in the rollers, a combination toolholder being made so that the drilling, countersinking and facing operations could all proceed together. This procedure cut out the punching method and the fact that the centering was done prior to the casting of the rollers saved a lot of unnecessary weight lifting—the bar arbors being comparatively light.

Rough Turning Arbors

The next operation, rough turning the arbors, was done on an old center lathe which was fitted with a dead stop for setting the tool, and a rough-turn limit gage to control the diameter within moderately wide limits. A high spindle speed and a fine traverse were used and only a single cut was taken, the time on this and the previous centering operations being 6 and 4 minutes per roller, respectively.

Rough turning the cylindrical portion of the roller was also tried, in the first place, on an old center lathe but the results were not entirely satisfactory. One end of the arbor projected about 5 in. from the end of the roller and, since the diameter of this was only $1\frac{5}{8}$ in., it was impossible to take as heavy a cut as would have been easily practicable with a more rigid mounting in the machine. Further, the old lathe had not sufficient belt power to drive a stellite tool up to its maximum cutting capacity. Even with the old lathe stellite had been found to give much better results than had been obtainable from the best brand of high speed steel available, but it was quickly apparent that an improved method of carrying the work in the machine would allow of a still higher rate of production.

A Single Purpose Roughing Lathe

A design was accordingly got out for a single purpose lathe with ample power and a collet arrangement for both head and tailstocks to support the roller by the arbor and have as little overhang as possible. It will be remembered that the core was vented by a pipe projecting through the end of the roller. The new roughing lathe was arranged with a pin driver which entered the hole left by driving the vent pipe into the roller. The drive was by fast and loose pulley through change gears for varying the speed. The pulleys were capable of transmitting 10 hp., an amount which proved ample for the purpose. The feed mechanism was also provided with fixed center change gears so that it could be varied as occasion demanded or experiment demonstrated. The tool-holder had hand cross feed only, a large micrometer dial being fitted so that definite tool adjustment could be made to compensate for wear of the cutting edge.

On the 4-in. diameter rollers the cutting speed was 100 ft. per minute and the feed $\frac{1}{32}$ in. per rev. of spindle, the stock to be removed being about $\frac{1}{4}$ in. in diameter. Under these conditions is was possible to rough turn the rollers at the rate of four per hour, this rate being a continuous day-in and day-out production. With a spurt it was possible to do them in from 10 to 12 minutes, but the average worked out at 15 minutes for a day's run.

Durability Variable

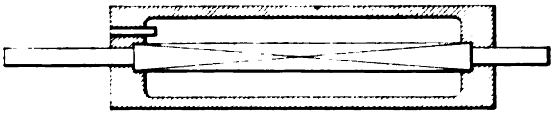
The durability of the tool varied greatly, if the rollers were true enough to ensure the cut getting well under the skin, the tool would last a couple of hours without regrinding. If, however, an eccentric casting was encountered, the cutting edge was destroyed almost immediately. The girls were kept supplied with ground tools which they very soon learned to set for themselves, more particularly since the diameter limits were of the very widest.

The next operation, that of facing square the ends of the roller, was performed in another old center lathe. The work was mounted between the centers in the usual way and in addition was supported close up to the cut by a fixed steady rest. The cut was fed by hand and very little difficulty was experienced except in the final squaring out of the corner, which was apt to prove rather troublesome because of the chilling of the cast iron at this point by its contact with the steel of the arbor. The difficulty was very largely overcome by providing for front and rear tools, the latter for the facing operation and the former for the finishing of the actual corner.

This operation was a comparatively long one, the time being about the same as for the rough turning, much of the excess of time being due to the amount of tool-grinding and re-setting made necessary by the dulling effect of the chilled metal. To obviate this trouble, a slight alteration was made in the design of the roller, as shown in Fig. 2. The ends were recessed

in the casting as at *A*, which, of course, necessitated the casting of the rollers on end. With the altered design of roller the time for ending was reduced to 8 minutes per roller, or little more than half the previous time.

The next operation tabulated above was the grooving, either spiral or diamond as occasion demanded, but it



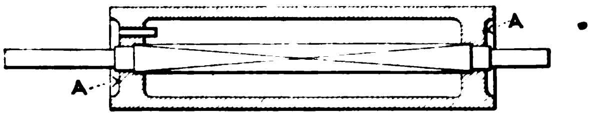


FIG. 1—PLAIN ROLLER FOR RUBBER MANGLE
FIG. 2—ALTERATIONS IN SHAPE OF ROLLER TO FACILITATE SQUARING OF ENDS

was later found desirable to introduce a supplementary operation prior to the grooving. It must be understood that quite a large proportion of the rollers were "plain," i.e., they were not grooved, and it was really to accommodate the plain rollers that the extra operation was finally introduced. This operation was a finishing cut taken with the roller running on dead centers just as it would subsequently be for grinding. It was found that with the very heavy cuts taken on the rough turning lathes it was practically impossible to obtain anything like concentricity with the center holes. This meant that considerable time was required by the grinding operation.

Cast iron is not, under the most favorable conditions, one of the best metals to cut with a grinding wheel. If the wheel is not suitable for cast iron it is almost impossible to cut with it at all—it glazes and whistles and will only remove an infinitesimal amount of stock. With a suitable wheel, with a grade on the soft side and a rather coarse grain, infinitely better results are obtainable, but even with this combination the productive rate is too slow to allow of much eccentricity of the work.

It was found that considerable time was saved on the average by taking a light skimming cut as a preliminary to grinding. The grinding operation had been quite regularly taking over half an hour per roller (average), much more in cases where the eccentricity was extra bad, and it was found that by taking a finishing cut in the lathe at a cost of not more than five minutes' time, the grinding time only averaged 12 to 15 minutes. This, of course, showed a net gain in the finishing time and, what was of still greater importance, it doubled the capacity of the hardest worked machine, the grinder, the output of which was the limiting factor in the output of finished rollers. It was only possible to allocate one grinder to the job and so it was important that this machine should be worked up to its maximum productive capacity.

As previously mentioned the original method of grooving had been by cutting in a lathe similar in every way to screw-cutting. This had been a laborious, time consuming, make-shift sort of scheme, which was very soon superseded by milling, the roller being mounted between the centers of the dividing heads and the helical grooves generated by connecting up the table feed screw of the machine to the spindle of the dividing head by change gears in the usual way. Since the helix angles were generally small, 18 to 30 degrees, the swiveling capacity of the table was not large enough to allow of the cutter being mounted on the ordinary cutter arbor.

Therefore, a universal milling head was made which itself swiveled through a complete circle and thus allowed the table of the machine to be operated in its normal straight position. This attachment was bolted to the face of the column of the machine and the cutters operated at the back of the roller, as shown roughly in Fig. 3. There were usually two cutters, ⅛ in. saws, mounted side by side on the cutter arbor with a spacing washer of suitable thickness between to give the proper groove pitch.

It was never very clear, apart from the reasons already given, what was the real object of the grooving, or rather what determined the dimensions of same. In some cases the grooves were of comparatively short lead giving what was known as "vertical" diamonds, *A*, Fig. 4, while in others the leads were long and the diamonds then had their major axes lengthwise of the roller, in which case they were known as "horizontal" diamonds *B*, Fig. 4. Again, one customer invariably would ask for grooves $\frac{1}{16}$ in. wide and deep, others would want $\frac{1}{16}$ in. wide, ⅛ in. deep, while the majority were content with what came to be accepted as standard, ⅛ in. x ⅛ in.

Not only was there much variation in the size of the grooves, but the dimensions of the resulting diamonds were just as diversified. In fact, it was never definitely certain throughout the whole course of the work, what the customer actually meant when he specified the size of diamond he required. It was usual to receive the orders in the form of so many pairs of a certain size roller, diamond grooved, with diamonds (say) 1 in.x½ in. Ordinarily this had been taken to refer, not to the actual raised diamond itself, *Bb*, Fig. 5, but to the pitch, or center to center dimensions, *Aa*. For quite a while this had been recognized in the shop as the system of dimensioning employed. Later some of the customers began to kick—they suggested that when they called for 1-in.x½-in. diamonds, they meant 1-in.x½-in. ***diamonds***, and not some hypothetical size which seemed to bear very little relation to the one called for. Other customers accepted the center to center interpretation without question so eventually we kind of drifted into a habit of taking either interpretation according to which was most convenient for the particular job in hand.

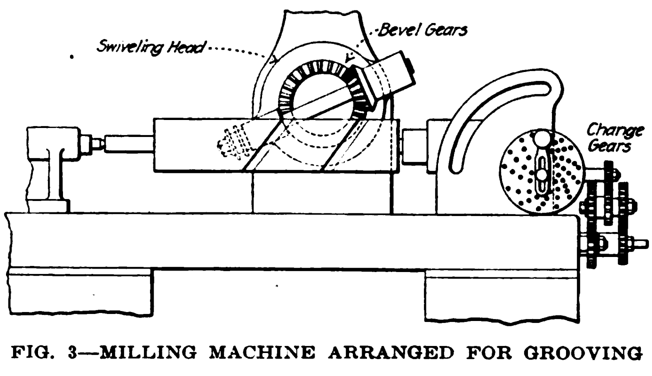


FIG. 3—MILLING MACHINE ARRANGED FOR GROOVING

In this connection it might be thought that it would have been quite a simple matter to have written or interviewed the customers and got to know definitely what was required. It should be remembered that the whole of the product was shipped abroad, the orders being booked through various merchants, agents,

shippers, etc., who knew nothing about the details of the work. And though many efforts were made to get some really definite information about the matter, nothing tangible resulted, the information we did succeed in getting being very contradictory and largely composed of the personal opinions of people who knew nothing, or next to nothing about the job. Since the demand for the product was in excess of the supply, it was possible to take liberties which could never have been taken with a more normal market.

Suppose then an order called for 4 in. rollers with 1-in.x½-in. diamonds, the vertical dimension of the diamond, the one running around the circumference of the roller, was divided into π times the diameter of the roller, or, in the above example $4 \times 22/7 \div 1 = 12.57$. This gives the number of leads required to produce the specified size of diamond. Since it is not practicable to cut fractional leads, the nearest even number is taken, 12 in this case. Had the calculated number of leads worked out to 13.5, 14 would be the actual number taken. The reason for taking the nearest *even* number is because in the grooving operation two cutters are working simultaneously and, if there were an odd number of grooves, one traverse would be taken with only a single cutter at work.

Having determined the number of leads, this is then multiplied by the horizontal diamond dimension (½ in. in this case), and the product is the lead of helix, for which the milling machine must be set up. In our example the helix would be $12 \times \frac{1}{2} = 6$ in. lead. The only dimension now required is the angle *C*, Fig. 4, and the cotangent of this angle is found by dividing the lead into the circumference or $12.57 \div 6 = 2.09 =$ cot 25½ degrees.

The time taken for milling the grooves was about 30 minutes per cut, two grooves, so that on the above roller with twelve grooves about three hours would be required *for each hand*, or six hours in all. The operator tended two machines, the usual practice being to have one machine set up for right hand and one for left hand, and change the rollers over from one machine to the other. The output obtained amounting to under ten pairs of rollers per week was entirely too insignificant to even begin to meet the demand.

The machines were given every attention, attempts

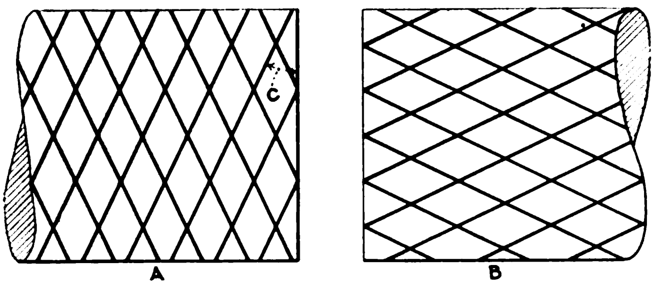


FIG. 4—TWO STYLES OF DIAMOND GROOVING

were made to increase speeds and feeds, and a double shift was put on to run both night and day, but incoming orders continued to arrive faster than the outgoing ones were delivered. For the more standardized groovings multiple tools of the chaser type were made for use in the lathe. For a twelve lead roller the tool would have six correctly spaced teeth so that the whole of one hand could be produced with two sets of cuts only. This arrangement, while being a big improvement over cutting one groove at once was not proportional in rate of production to the number of cutting edges simultaneously engaged. It was found that as the number of cutting edges were increased, the feed traverse had to be reduced—it should be remembered that cutting six ⅛-in. grooves at once meant an aggregate width of cut of ¾ in., and this width of cut was not conducive to heavy feeds when the springiness of the arbors was taken into account. It was possible, however, to do the job in from a half to a third of the time required by

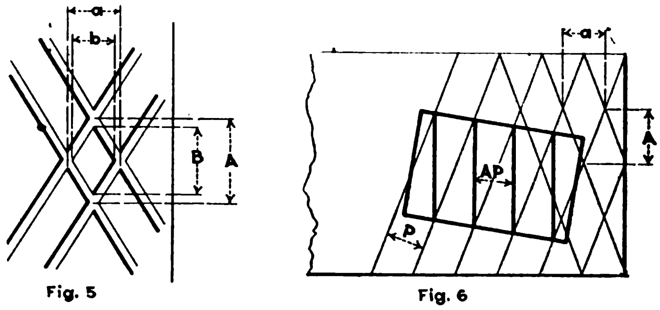


FIG. 5—DIMENSIONS OF DIAMONDS
FIG. 6—PITCHES OF DIAMONDS AND HOB

the single tool method and this brought the rate of production more nearly in line with that obtained by milling. Our lathe equipment, as previously stated, was too small to allow of above one machine being put onto the work, and further, the job was really too trying on the nerves by ordinary lathe methods.

An experimental single purpose milling machine was made with a view of building others later on if the idea proved successful but unfortunately the machine was made with too narrow a range, there were many leads that were called for which could not possibly be obtained on the machine. The design was also inherently weak, lacking in both power and rigidity which resulted in a high percentage of broken cutters.

Someone then had a brain storm, why not hob the grooves? The variation in the grooving was rather an obstacle, but it was decided that the idea was worthy of very serious consideration. After consulting some of the principal customers, it was found possible to considerably reduce the number of groove designs so that the stock of hobs required could be kept within reasonable limits. While some of the customers concurred in this standardization of the grooving, it must be admitted that it was a case of Hobson's choice, if they didn't agree to accept our standards they had to do without the goods. Most of them wanted the goods more than they wanted any particular standard grooving. We accordingly proceeded to get out a line of groovings which would most conveniently meet the limitations of the hobbing process.

Now as previously mentioned the specified dimensions of diamond referred to in the axial and circumferential measurements, as shown in Fig. 5 and Fig. 6. All calculations, however, started with the *normal* pitch, *P*, Fig. 6, this being also the normal pitch of the hob, which had to be conformed to if at all possible in order to keep the stock of hobs as low as possible. The normal pitch of the hob in turn depends on the axial pitch, *AP*, and the hob diameter, being the product of the axial pitch and the cosine of the thread helix angle. The cotangent of the helix angle is found by dividing the axial pitch into the pitch circumference of the hob.

It was essential that the number of hobs be kept as low as circumstances would allow because it was neces-

sary to make two hobs—one right and one left hand, for each normal pitch, this being due to the fact that such wide spiral angles as were required on the product could only be cut by using a hob of the same hand as the spiral itself. As both right and left hand spirals are required in the production of diamond grooves two new hobs were necessary for any special size of diamond that might be called for. As the hobs were expensive it had to be a substantial order that allowed for the making of two of them. Hence the desirability of maintaining our accepted standards as far as possible.

There was no standard gear hobbing machine on the market which would accommodate the lengths required in the production of the rollers, so we were compelled to design and build the machines ourselves. Fig. 7 shows diagrammatically the style of machine designed and in which, due to several causes, chief of which was the extreme urgency, there were several details of the design which subsequent experience proved to be wrong in conception. The location of the differential, for example, proved to be entirely wrong in principle, whereas such a mechanism should be designed so as to transmit as small a load as possible, with the design adopted, this unit was actually subjected to a multiplied load. In any hobbing machine, or any other machine tool so far as that goes, it is essential that definite velocity ratios be maintained under load, or at any rate, with as little spring as possible. Unfortunately, the design we produced was very much lacking in this important respect, the various transmission shafts and their supporting members were not as rigid by a long way as they might have been. The result was that there was considerable vibration and noise when the machines were working and, what was more serious, a high rate of mortality in hobs. The production was better than anything we had previously accomplished, one hand of a 4-in.x20-in. roller being grooved in 30 minutes, but we were not yet satisfied that we were getting the best attainable results and, though a new design of machine was put in hand of much more rigid construction, we were never able to proceed with the building of same until trade suddenly fell off and there was no longer so insistent a demand.

With the proposed new design a much more rigid construction was followed throughout the whole machine. Generally there was less overhang of brackets, shafts and gears, while the work spindle was made much larger in diameter and driven by a worm gear, *behind* which the differential was located. This was considered to be a most important factor—the load on the differential and the main change gears instead of being equal to, or greater than, the pressure of the cut, was only about 2 per cent of this, thus giving a much more rigid construction at this point. Had circumstances allowed of the new design being completed, there is no doubt whatever that it would have proved itself to be a marked improvement on the original design, while the operative cost would also have been considerably less by reason of the longer life of the hobs.

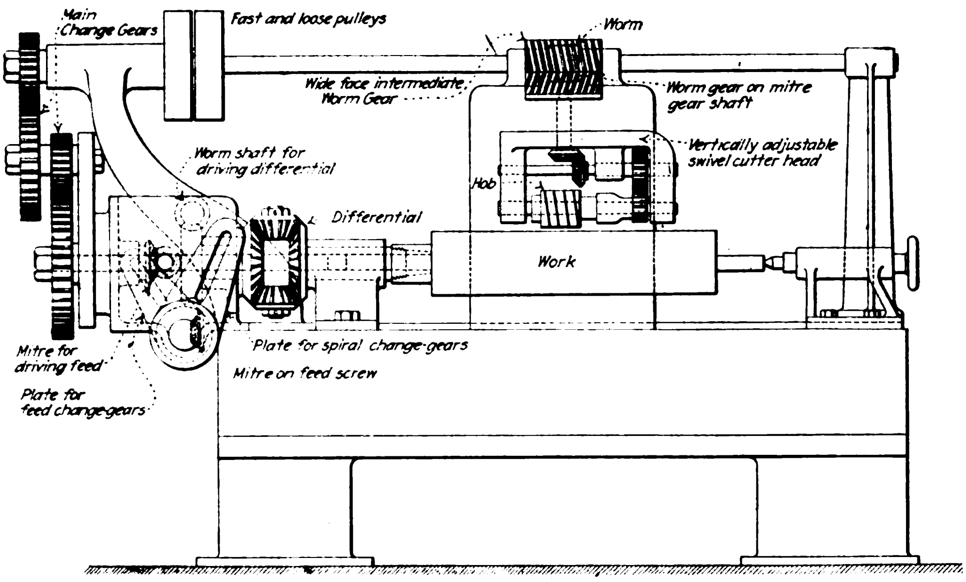


FIG. 7—HOBBING MACHINE FOR GROOVING ROLLERS

By working the machines night and day, using the milling machines for special sizes, we were able to reach a production of nearly two hundred pairs of diamond grooved rollers per week. This output quickly helped us to overtake our orders, after which it was quite an easy matter to meet the demand by our greatly increased productive capacity.

Another scheme for the grooving operation which was considered but never put into operation was by means of a special lathe fitted with automatic reverse to the saddle and a multiple toolholder somewhat similar to a diehead. This toolholder was to have as many cutters as there were grooves to be cut, each cutter radiating to the center of the roller and having some form of scroll exactly on the same lines as a die head, to feed and withdraw all the cutters simultaneously. The machine was to have a powerful drive, preferably through worm gear and the carriage, as stated, an automatic reverse so that it could be set for various lengths of roller. The actual cutting was to be done by a series of comparatively light cuts, about 0.006 to 0.008 in. per traverse of the carriage, the feeding arrangements of the cutter head being such that successive cuts were automatically applied and withdrawn for the idle return motion of the carriage. With a cutting speed of about 15 feet per minute and a feed of 0.006 in., it was expected that one hand could be completed in about five minutes, a rate of production which was a considerable improvement even on the hobbing process. It was also suggested that if the idea was carried a step further and a double cutter head made so as to cut one hand on one stroke and the other on the return stroke, we should be able to completely "diamond groove" a roller in five minutes cutting time, a remarkable rate of production.

An objection to the scheme was the heavy initial outlay on cutter heads, a separate one being required for each different number of leads, but if some definite standard, or two or three definite standards, could have been adopted to meet all requirements, then there were great possibilities in the idea. Another objection, which was anticipated was that the corners of the diamonds would probably be broken, more particularly

in cast iron, by the tools chipping the material. As the rollers had originally been cut in the lathe and the new scheme was only a development of the same principle, this particular objection did not appear very reasonable, we should have risked the trouble had not the slump come along and temporarily suspended our activities in this direction. The rubber trade slump came along some time before the general slump paralyzed nearly the whole of our industry, let us hope that it will also pick up first and be the harbinger of better times all around.

With the system of turning the rollers previously outlined and the hobbing process for cutting the grooves, the labor cost for a pair of 4-in.x20-in. diamond grooved rollers apart from moulding was only about a shilling. With the proposed new grooving process this would have been still further reduced. This was probably only one sixth of the original cost, a saving which allowed of a decent margin of profit, where there had previously been a substantial loss, combined, fortunately, with only a small volume of business. Had there not been a big demand, it would have been impossible to make such substantial savings because we should not have been justified in the rather heavy capital outlay which the big demand easily allowed for.

Rewards for Money Saving Ideas

By John Thomas

Some time ago I read an article in the *American Machinist* which advocated promotion as a reward for the man who contributed a money saving idea to his firm. Now promotion in such a case would be all right if we always happened to have a higher position open when we needed it, but that is very seldom the case. The longer we wait to promote a man after it should be done, the less he will appreciate it. To him the reward will appear much the same as a bill paid long after it has fallen due.

It is interesting to note just how the contribution of an idea is handled in different shops. In some shops the idea is put to use as a matter of course and no mention is made of the fact to anyone. Depending on the mental attitude of the man who furnished the idea, the net result to the firm may be good or bad. If he be a man who finds pleasure in creation, the fact that he has accomplished something beyond his fellows in the shop may be reward enough for him and he will not feel that the firm owes him anything beyond his regular pay. If he does feel that he is entitled to an additional reward, however, and does not even receive a word of appreciation, the firm has lost a valuable asset. First it loses the goodwill of an employee and next the possibility of any more ideas from that source.

In other shops attempts have been made to cover the matter by means of suggestion boxes placed about the shop and offering a money reward for the best idea of the month. The trouble with most of these places is that some firms seem to be trying to get something for nothing. For example, a reward of $10 for an idea is childish. No idea for an improvement which actually is an improvement over the existing method or plan could possibly be worth as little as that sum. If the idea does not warrarnt a reward of over $10 I should be afraid that it would be so close to the line that in practice its adoption might result in a loss.

What I am trying to point out is this, let us not fool our time and money away on doubtful ideas but pay an honest price for ideas that have a real and substantial value. My suggestion would be to make the reward in money and the field open to anyone. Let the high priced men show their superiority, then when a good suggestion turns up pay a definite percentage of its value as a saving.

It would be possible to have one or more men pass on all suggestions offered, estimate their cost of installations and value as a saving and then figure the size of the reward on the order in hand, or, if the product be running continuously, on the saving for a period of time. Handled in this way the reward comes out of the saving itself. The plan of offering a stipulated amount places all suggestions on the same plane as regards value, which is certainly not the truth. A saving of $5,000 should be worth at least 10 per cent or $500 to the man who was responsible for the saving.

The only trouble seems to be that most firms can't bring themselves to pay out any considerable amount of money for an idea although it may result in a saving out of all proportion to the reward. They seem to be ready and willing to spend a thousand dollars or more for an improved machine which will save the wages of one man, yet if an idea were offered which would make an equal saving they would hesitate a long time before giving up even $100.

Ordinarily, the responsibility for improvements rests with a few men and, no matter how brilliant, they will hardly think of all of the possibilities. Contrasted to these few men we have in the shop probably twenty times as many men thinking of but one or two details at one time. Naturally, one would suppose that the men who are in constant contact with the details of a job would be the first to see an opportunity for improvement. Twenty minds, even though they may not be brilliant, will approach the subject in at least twenty different ways while the one brilliant man might probably think of a dozen.

Few employers seem to realize the almost infinite possibilities of encouraging the submission of ideas for improvements from their employees. A definite plan for promoting and taking care of such suggestions should be a part of every shop organization. Practically every man in the shop has some ideas about his work that have a value. The only trouble is to discover the valuable ones. Employers who are slow to bring out the suggestions may be interested to learn that some of the greatest economical systems were devised by men in the shops. One such plan developed successfully may pay for a thousand failures.

New Bill for Reorganization of Government's Executive Machinery

Legislation emboding the administration's plan for the reorganization of the Government's executive machinery probably will be introduced during the December session of Congress. If the draft of the bill cannot be perfected in time to insure action during a session which necessarily must be devoted largely to appropriation bills, it will be taken up at an extra session which, it is believed, will be called next Spring.

It is understood that the administration bill will not provide for a Department of Public Works. There will, however, be a grouping of public works activities under the close supervision of an assistant secretary.

Tool Checking Systems in Foundries

Identification Numbers for Patterns, Loose Parts, and Core Boxes—Designating Regular and Special Patterns—Shelving and Card Indexes

By W. J. SANSOM

IT IS CONSIDERED unusual to apply tool checking systems to foundries but it has been successfully accomplished and has brought about economical results. Either the single check or the register system (described in *American Machinist* p. 713, vol. 19) can be used and as the attendant's duties are naturally light, other work can be combined with the checking of tools to advantage. If there is a satisfactory arrangement of departments the tool checker may also check out patterns and attend to their storage. In addition, he may give out accessory materials such as chaplets,

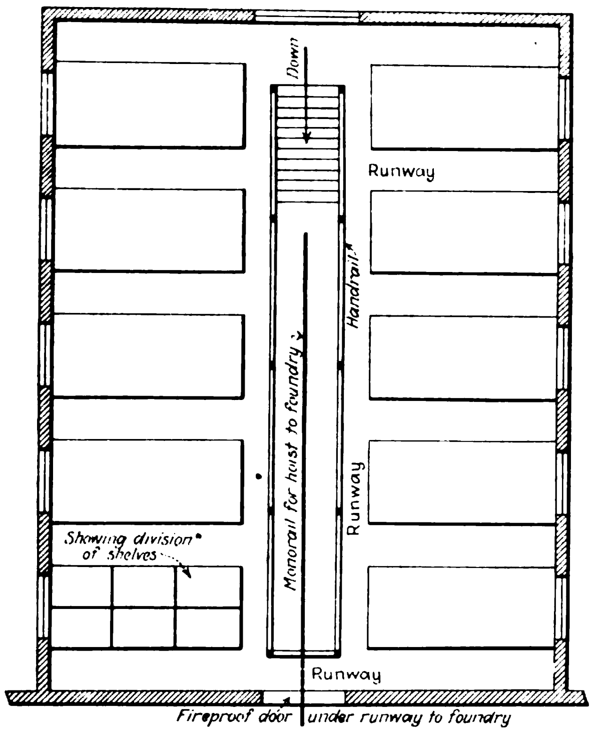


FIG. 1—PLAN OF PATTERN STORAGE ROOM

blacking and other facing materials, nails, fire clay, and so forth. He may, after instruction, make physical tests on castings, or, in the case of a steel foundry, turn up test bars in a lathe providing the machine is in or convenient to the check room. All tools such as shovels, rammers, riddles, sprinklers, pattern lifts, pneumatic tools, patterns, and in fact every tool and appliance ever used in the foundry should be under the attendant's control in exactly the same manner as the tools in the machine shop check room.

It has been a matter of great surprise to the writer to note the continued lack of system in the storing of patterns in many of the large shops. It is not unusual for a search for a particular pattern to last an hour or more. This is all the more surprising in view of the fact that pattern storing is one of the simplest of the problems confronting the foundryman and requires very little effort in its upkeep, providing the matter is taken care of in a systematic way. In many cases, the foreman of the department is the only person having any definite knowledge of what patterns are on hand and where they may possibly be found and he is not very sure of it because he depends upon memory for his information. Should the foreman through illness, death or other reason be suddenly removed from his position it would surely be a matter of great difficulty for his successor to carry on his work efficiently through lack of knowledge of a very essential portion of his equipment.

Every pattern should be given an identification number by the engineering department even though the pattern is to be used only a few times. If the part to be cast is a portion of the regular product of the shop it should be plainly marked with the number of the piece. Should the pattern be for a jig or fixture or some other special appliance, it should be given a number and, to differentiate between the standard product and special pieces, the number could be preceded by a letter. A jig pattern for instance should be identified by using the letter J to precede the number. Should there be loose or extra pieces with the pattern, each piece would be given the same number as the main portion of the patten, succeeded by a letter. As an example, a jig pattern, having one loose part would be styled J 834 for the main part, and J 834 A for the loose part.

Core boxes should be numbered in exactly the same way as the pattern and if more than one core box is used, then the same system of lettering for extra parts should be carried out. Core boxes for stock size cores should also be given a number. The numbering of patterns and core boxes is essential to the success of the system and should be attended to by the engineering department and a record made thereof.

The next point for consideration is the suitable arrangement of shelving. A plan of a pattern storage vault is shown in Fig. 1.

Each set of shelves is known by a letter and will be called a section. Sections may be built as high as conditions permit and may have any number of shelves,

PATTERN RECORD	Number	
Number of Parts	Section	Bin
Corebox		

FIG. 2—PATTERN RECORD CARD

each shelf being divided into compartment by the use of 2x4 lumber as it is not necessary to run the partition vertically from shelf to shelf and it is indeed preferable to permit a free circulation of air through the shelves besides giving the added advantage of unobstructed light. If the shelves are higher than can be reached from the floor then a runway or platform may be built

for the upper shelves with substantial steps from it to the floor.

It will, of course, be an advantage to store the lighter patterns on the upper shelves. Each compartment within the section will be given a number. Using our previous example, pattern J 384 might be stored in Section D-22. A card record must be kept of each pattern, an example of which is shown in Fig. 2.

Should a pattern be returned to the pattern shop for repairs or changes a note of this removal is made; upon the return of the pattern to storage the memorandum should be destroyed. If the foundry in which the system is introduced is a jobbing concern there will be numerous patterns left in its care by outside parties. These patterns should also be recorded in the same way as patterns owned by the foundry using the customers' pattern number on the record. It would be well to segregate customers' pattern records from those of the foundry so that it will be possible to know exactly which are customers' patterns.

Patterns are actually expensive tools and difficult to replace. A jobbing foundry that takes pains to care for them properly will be regarded with favor by the customer. Therefore an efficient pattern storage system is an asset to the foundry. This system will also lend itself admirably to the register system of disbursement described in a previous article in the *American Machinist.*

Learning the Trade Forty Years Ago

By W. S. Davenport

At about this time I received a letter from a cousin in Rutland, Vt. (who has now, by-the-way, been employed by the Howe Scale Co. for 59 years) to the effect that he had secured a place for me in a Rutland shop where buttons were made from vegetable ivory. I accepted this job and made preparations to go to Rutland at once, for, though it was not a machine shop, there would be machinery in it and anything in the way of machinery was a passion with me.

At first I was instructed in the art of sharpening, on an oilstone, the knives that were used in the button lathes, and after several weeks of this employment, was given a lathe to run. Running a button lathe, however, is no fun. The operator has to stand all day (ten hours a day, six days a week) on one foot, while with the other he operates the pedal that opens and closes the "grippers" which hold the stock; and in the meantime his hands are kept busy feeding the stock and manipulating the levers that control the knives.

After three months of this arduous labor I received a letter from the Fairbanks Scale Co., to whom I had previously applied, stating that they had a number of young men just about to begin an apprenticeship term and that if I cared to join I could come on at once. This seemed to be my long cherished opportunity to learn the trade and it is needless to say I accepted the offer immediately. I worked for the Fairbanks Co. for a month before I found out what they were going to pay me, and then I learned that it was to be one dollar a week with board and lodging at the company's boarding house.

Actually they had no regularly indentured apprentices but there were a number of young fellows working there on scale parts, running different kinds of machines, who were making more money than was offered to me as an apprentice. I was offered the choice between an apprenticeship and the kind of a job the other fellows had and, foolishly, like many boys of the present, I appraised the immediate gain against the possibilities of later benefits and so began there as the "kid" in the tool crib at the munificent wage of $1.12 per day.

During my first month I managed to gain some interesting experiences, one such being the turning of a countershaft for use in the shop. This shaft was nearly as long as the lathe would accommodate and, as I had never heard of such a device and was given no instruction with reference to it, I proceeded to turn the shaft without a center rest; the result being that it was some bigger in the middle than at the ends.

Cutting a Keyway Under Difficulties

However, after I had filed and polished the shaft all over it *looked* pretty good, so I proceeded to cut a keyway in it for a pulley, using an old screw planer for the purpose that was not at all particular about reversing in the same place on each stroke, in consequence of which the job of keyseating was not a complete success.

The man who was to use that shaft (it was a countershaft for another lathe) was anxious to get it and volunteered to assist me in putting on the pulleys and clutches. We first put in the key and then started to drive the cone pulley over it but we did not seem to be making much progress. He finally asked me if that pulley went on tight before the key was put in, and when I was obliged to admit that I had not tried it at all he was much disgusted and made various uncomplimentary remarks about my ability as a machinist.

In the Fairbanks' shop where I was at this time employed, there were many old tools in the machine shop, one of them being a "chain feed" lathe. On this lathe an endless chain ran over sprockets inside and at each end of the bed, and to the upper side of this horizontal chain the carriage was attached. At the headstock end the transverse shaft to which the sprocket was keyed protruded through the bed, and upon its outer end was a large handwheel by means of which the carriage was moved to traverse it along the shears.

Guessing at the Depth

When facing the end of a long shaft in this lathe it would be necessary for the operator to set his side tool according to his best judgment, walk to the other end of the lathe and turn the handwheel to feed the tool to the cut. As in this position he could not see what the tool was doing he had to trust to luck that everything was all right and, when he thought he had taken off sufficient stock, go back to the opposite end and take a look at it. As it never was all right the first time, he could then pace off the distance once more and try again. To do a good job in this way was quite an art, but was not in accord with what we now call "production."

Among many interesting machines designed for scale work there was one for notching the beams of railroad scales. These beams were of cast iron, planed all over, and when ready for the notches were placed in a long slot in what was called the "log" with but a small part of the upper edge protruding. The log was given a regular oscillatory movement to carry the work under the single cutter and back again, while at the end of each such movement the entire carriage was spaced forward a distance equal to one notch on the beam.

Methods of Machine Tool Design

Continuation of the Description of Feed Mechanisms—Cam Adjustments and Stops —Adjustable and Spring-Backed Rollers—Stops for Several Tools

By A. L. De Leeuw
Consulting Editor, *American Machinist*

WHEN A CAM is made out of a solid piece of material, there is no possibility of adjusting the cam as to the amount of its action. For instance, if we should have a face cam with a distance between the high and the low point of 2 in., then there will be a travel of 2 in. and no adjustment of this amount is possible. The same holds good if we have a drum cam in which the groove is cut into the metal itself. Any adjustment we might want will have to be obtained in some other manner. If a cam is made by fastening pieces of metal to a disk or drum, adjustment is possible in various ways. In Fig. 189, *A* is a disk to which cam strap *B* is fastened by means of a couple of screws going through slotted holes. Screws *C-C-C-C* adjust the cam strap to any desired position within the limits of the construction. Such adjustment makes it possible to increase or reduce the stroke, or to have the stroke start or finish at any desired point, always within given limits. The screws *C-C-C-C* make the adjustment more positive but can be left off where a less refined adjustment would be satisfactory.

The same kind of adjustment can be given to a cam strap on a drum cam. In addition to the slotted holes in the strap, a number of tapped holes in the disk or drum may be provided so that it becomes possible to place the strap in any desired position over the entire surface of disk or drum. The nuts for the adjusting screws *C* may be screwed into such holes and may also be placed wherever desired. When a cam controls one operation only, we will find three requirements for adjustment. Let us take for example a drum cam which pushes a slide forward and returns it again to the starting point. The requirements for adjustment are these: (1) It must bring the slide to the proper point; (2) It must have a stroke of the proper length; (3) It must act at the proper time. The third requirement is sometimes met by fastening the cam drum or disk cam to the shaft by means of set screws so that it is possible to shift the cam around the shaft any desired amount and then clamp it in position. This is a very crude and unsatisfactory method of adjustment and is, at best, only applicable to cams which do not perform a heavy duty. A better method is to have a disk permanently fixed to the shaft and to have means to attach the drum or disk cam to this disk at any point of its circumference, either by a number of tapped holes or a T-slot or a combination of tapped holes and slotted holes. As a rule it is not necessary to make this adjustment, because it is well possible to lay out the requirements of the cam to a sufficient degree of accuracy so as to be able to place the straps in the proper position or mill the disk cam to the proper shape without further adjustment.

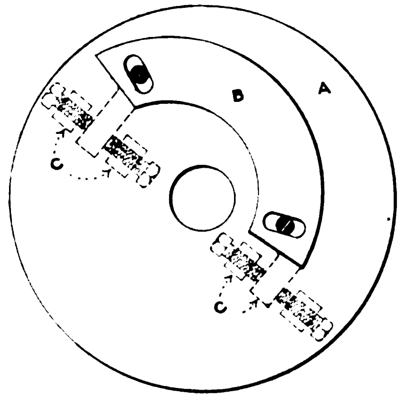


FIG. 189—ADJUSTABLE CAM STRAP

Where such adjustment is required, however, the amount of movement necessary to make up for the error in the original lay-out or in the milling, etc., is always necessarily a small amount and there is no necessity of shifting the cam through more than a very small angle. Slotted holes and bolts would meet such requirements, especially if we should again use adjusting screws such as are shown in Fig. 189. The adjustment of the stroke has been mentioned before and cannot be taken care of if the cam is one solid piece. It is possible, however, to increase or decrease the movement of the slide if we are willing to introduce intermediary members. Fig. 190 shows a construction illustrating how the amount of stroke of a cam can be increased or diminished when transferred to a slide. *A* is a cam and *B* is its groove. The roller *C* is held in one arm of a slotted bell crank and the connection *D* can be bolted to the second arm of this crank at any place along the length of the slot *E*.

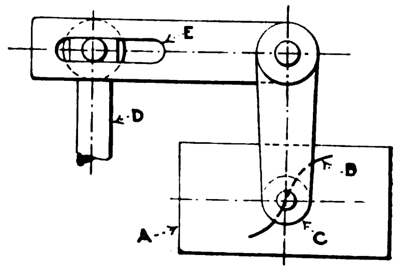


FIG. 190—SLOTTED BELLCRANK FOR ADJUSTING LENGTH OF STROKE

The most important adjustment is the one mentioned under the first item. As a rule it matters very little whether the stroke of a cam is somewhat too much. In fact, in the majority of cases the stroke of a cam is made more than is necessary for the operation and the excess of movement is called the "advance" and is, as a rule, made on high speed. Thus, the loss of time is negligible. On the other hand, the exact point at which the forward movement ceases is often of the greatest importance. Stock feed may have to be stopped at an exact point so as to get the proper length of piece or, more important still, a facing tool must work up to a certain point and this point may be limited to one or two thousandths variation. Either a counterbore may have to be made to an exact depth or a turning tool may have to come to some definite point. In such cases the adjustment should permit of great accuracy. Such adjustment can be accomplished either by moving the cam, the roller or by changing the connection between the roller and the slide to be moved. The adjustment indicated in Fig. 189 would accomplish the purpose but is not handy because this nature of adjustment is often required on account of re-setting or even dulling of the tool and, unless the cam strap to be adjusted is in a very accessible location, and preferably visible at the

same time, it would not be practical to make an adjustment to within one or two thousandths of an inch.

A good construction for this purpose is the following: The roller is placed on a stud which is not directly attached to the member to be moved but is fastened in a separate piece which can slide in that member, which is adjustable by means of a micrometer screw, and which can be clamped to that member. In some cases the member to be moved is merely a bar which holds a tool or possibly a piece of work. In such cases the bar is generally made of cylindrical shape for ease in

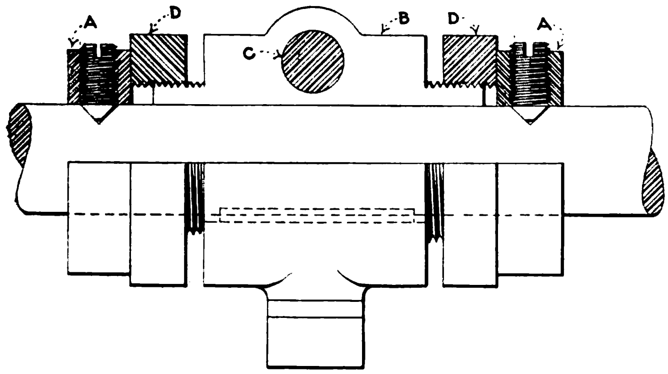


FIG. 191—ARRANGEMENT FOR ADJUSTING CAM ROLLER

machining and a collar holding the roller is clamped around it. In addition, a couple of collars are provided for extra safety against end movement. These latter collars are indicated by the letters *A* in Fig. 191. They are set-screwed to the bar or held in position in some other suitable manner. The collar which holds the roller is indicated by the letter *B*. It is split and can be clamped on by means of the bolt *C*. Extensions of this collar are threaded so that the collars *D* can be brought to bear against collars *A*. By turning both of the collars *D* the roller can be moved either to the right or to the left. A similar construction could be used to adjust the drum cam itself, should the cam be mounted on the bar.

Many other methods of adjustment may suggest themselves. We only want to mention here a case which requires special care and that is when the nature of a tool is such that very frequent and delicate adjustments are required. In that case the roller should be adjusted by means of a screw, as was mentioned before, and the screw should be provided with a small worm wheel operated by a worm with knob or small hand wheel. This gives the operator a chance to make relatively large movements with his hands for a very small amount of movement of the roller, so that he will be able to make the finest possible adjustments. Such cases, however, are rather the exception.

In the foregoing discussion of adjustments we imagined that the cam had only one function to perform. When we are dealing with such cams as we meet in automatic screw machines, we find as a rule that they must perform a number of functions. For instance, one cam may have to take care of as many as six forward and return movements of the turret, besides providing the necessary space for the functioning of other cams or mechanisms. In such cases the individual adjustment of cam straps is no longer practical. Not only would it involve too many devices, all placed on one cam drum, but the adjustment of one strap might make trouble by causing interference with other operations. Neither is it possible to adjust either the entire cam drum or the roller, because doing this might provide the proper stroke or positioning for one turret tool but it would have given the same amount of adjustment to the other turret tools, which is not desired and probably not permissible. In such cases a different method must be devised for the adjustment of all of the tools.

The tool which requires the greatest accuracy is ordinarily the facing tool. In order to make sure that the facing shall be smooth, it is customary to provide a small amount of dwell at the end of the facing cam, so that three or four revolutions of the spindle will be made without forward movement of the tool. This is really not a correct expression; we should have said "without a tendency of the cam to give the tool a forward movement." When the cam has ceased to push the tool forward we will find that there is still pressure between tool and work, due to the spring or deflection created by the feed and this deflection will cause the tool to penetrate still further, even though the cam has ceased to push it forward. The extra three or four revolutions are sufficient to obviate the effects of this deflection.

We should also notice that the deflection can never be very great, because when the slope of the cam is such that the feed is, let us say, 0.005 in. per revolution, we will find that the tool feeds very much less near the end of the stroke due to the fact that the roller must climb over the edge of the cam. In Fig. 192 an exaggerated diagram shows this condition. The feed slope is taken here at 45 deg., something we would never do for facing, but which is a condition which will bring out how the rate of feed is gradually reduced by the action of the roller. We see, then, that toward the latter part of the facing operation the amount of feed is a vanishing quantity. Nevertheless, it is the part of wisdom to provide a few extra revolutions without any feed at all. Though the foregoing method insures a smooth facing job, it does not insure an accurate position of the face. Looseness in the parts may cause the turret to advance one time a little more than the other and it has been found that the only safe way to do a really accurate facing job is to bring the turret up against a positive stop which should be located in such a manner that the turret or its slide strikes it before coming to the end of the movement which the cam would give it. Of course this would lead to breakage if there were an appreciable amount of difference between these two positions.

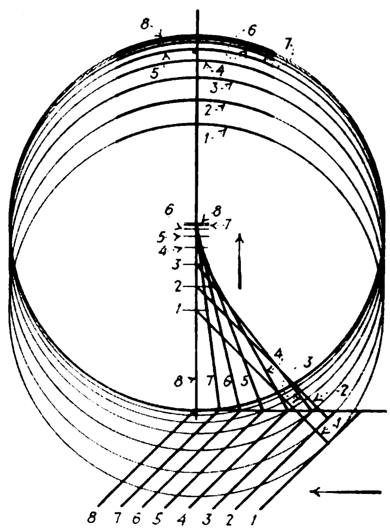


FIG. 192—DIAGRAM TO ILLUSTRATE DIMINISHING RATE OF FEED

As a matter of fact, the stop is placed so that the turret tends to advance one or two thousandths further after the stop is reached. One depends, then, on the elasticity of some of the parts to avoid breakage. For instance, where the cam is directly mounted on the shaft there will be enough spring in the shaft to provide this elasticity. For other purposes, however, it is better

not to have any elastic members in the mechanism, so that only the very small amount of compression possible in the slides, in the cam, and maybe a slight amount of deflection in the roller stud would be all the leeway we would have for the setting of the positive stop. And for this reason the following construction is recommended:

The roller is mounted on a stud which is held in a sliding member. This member cannot move backward because it butts up against a positive stop. It can move forward, however, for a short distance but is prevented from doing so by a loaded spring which pushes it back. By a loaded spring we mean the following: Suppose we have a spring which, when compressed $\frac{1}{4}$ in., exerts a pressure of 100 lb. Then it will exert a pressure of 200 lb. when it is compressed $\frac{1}{2}$ in., 400 lb. when compressed 1 in., etc. If the roller slide should bear up against such a spring before it is compressed, it would not prevent the roller from moving a very short distance because almost any little pressure would be sufficient to overcome the spring.

Backing the Roller with a Loaded Spring

If, on the other hand, the spring has been compressed 2 in. before it was placed in position, it would bear against the roller slide with a pressure of 800 lb. and, unless the pressure against the tool, that is, the feed pressure, were more than 800 lb. the roller slide would not move but would act as if it were made solid with the turret slide. If we know that the feed pressure never needs to exceed 800 lb., then such a spring will permit the cam to act on the tools as if there were no spring at all. And yet, when the turret slide strikes the positive stop, the spring will permit the roller to go a short distance further. This distance is never more than a few thousandths of an inch, but, supposing it to be as much as $\frac{1}{32}$ in., then the compression of the spring would increase from 2 in. to $2\frac{1}{32}$ in. and the pressure would increase from 800 to $812\frac{1}{2}$ lb. In other words, we know beforehand the maximum pressure which the cam may have to exert against the roller.

There is another advantage in this device. If a drill or other tool should break and present a positive obstruction to further movement of the tool, a wreck might result unless such an elastic medium were interposed. With the spring in position it will be possible for the roller to advance further without taking the turret along and the operator would have a chance to stop the machine before a wreck occurs.

Providing Stops for Several Tools

Though such a positive stop locates a single tool it cannot locate more than one. It may be necessary to provide stops for several tools. We may wish to counterbore, face, and turn to a shoulder. As a rule, when we have such operations to perform, we try to arrange the tools so that all three accurate operations are finished with one turret position. This insures the correct relation of the shoulder, the counterbored surface, and the faced surface one to another. All tools do not dull at the same rate, however, and, though the relation may have been perfect when the job was started, it is but a short time before the uneven wear causes a slight error to creep in. In the course of time some or all of the tools in this turret position may have to be re-sharpened and re-set and this re-setting is necessarily a lengthy operation when a high degree of accuracy is required.

If we could have positive stops for more than one turret position, there would be a chance of dividing up the operations among the different tools and each of the three accurate surfaces would become independent of the other two, so that the wear of each tool could be independently compensated for and the re-sharpening of a tool would no longer involve the maintaining of very accurate relations between a number of tools. In order to obtain such a multiplicity of positive stops we can arrange pieces between the positive stop and the turret slide, making the pieces of unequal length and adjustable.

Adjusting Individual Stops

We might arrange them in a star or small turret. The body of the turret would always bear up against the positive stop and projecting from the body we might have an adjustable set screw which can be clamped after being adjusted or which may be held accurately by a lock nut or by some other means. We might go still further and provide each of the set screws with micrometer adjustments. It would not only be possible to set each of them to the proper length but, after measuring our pieces of work and finding that it is too long or too short, say 0.003 in., we might adjust the corresponding screw that amount by means of the micrometer adjustment. The forward abutment of the loaded spring could be made to bear up against these screws. The turret in which they are located would have to index in unison with the main turret. It would, of course, be possible to leave out some of them for turret positions where great accuracy is not required.

The Production of Rustless Iron

There has been developed recently in England a "rustless iron." This material is iron to which a certain proportion of chromium has been added. A similar alloy called "stainless steel" has for some time been familiar to metallurgists. Stainless steel differs from rustless iron chiefly in that it contains small amounts of carbon.

In order to produce rustless iron, an iron-chromium alloy free from carbon, it is necessary that carbon-free iron and chromium be available. The usual forms of chromium, commercial grades of ferro-chromium, contain comparatively large amounts of carbon. The discovery of rustless iron has thus made it very important to be able to treat ferro-chromium by some process which will remove the carbon. Among the methods proposed is that of heating ferro-chromium in contact with hydrogen.

Through experiments conducted by the Bureau of Standards, of the Department of Commerce, it has been found that ferro-chromium heated in hydrogen loses carbon slowly at temperatures below the melting point of the alloy. When hydrogen is bubbled through ferro-chromium in a molten condition the loss in carbon is very rapid.

It may be possible to prepare low-carbon ferro-chromium by blowing hydrogen gas through molten ferro-chromium in a converter of the type used in the manufacture of Bessemer steel. This work is described in Scientific Paper No. 448 of the Bureau of Standards, available from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5c. per copy.

Direct Labor Costs versus Selling Prices

By Gordon Clark

The article on page 305, Vol. 56, of *American Machinist* by Harry Senior, with reference to looking to other items than direct labor costs for opportunities to lower selling prices, must strike a responsive chord in many of us who are more or less "fed up" on the idea that direct labor charge is the all important factor in determining the selling price of a product.

It is true that in a few industries the labor costs are a considerable portion of the selling price, but in the majority of cases the wonderful improvements in production machinery have steadily decreased the relative percentage of labor cost in the finished product. However, the direct labor items on the cost sheets seem to exert a hypnotic influence upon the average manager as he scans them in search of chances to lower costs to meet the severe competition that he encounters today. If he would spend an equal amount of time and energy in looking for savings in that "no man's land" that lies between bare costs of labor and material and the selling price of the finished product, he would find some excellent opportunities for the exercise of his acumen in the effort to lower the selling price.

Probably no series of articles recently published shed more light on this phase of the subject than did Mr. Bassett's recent articles in *American Machinist* on getting all of the production costs into the product, instead of having them tucked away under that convenient but most ambiguous term of "overhead."

In his search for the truth, after rearranging the cost system along the lines of Mr. Bassett's article, the manager might find that the pride of the shop, the big Humdinger machine purchased to clip a few pennies off the cost of machining a certain major item of the product, carried a true overhead, due to the floor space occupied, power requirement and depreciation of 480 per cent instead of the 250 which had been allotted to that division of the plant. As this fact soaks in he begins to see that the service orders for this piece, upon which they always considered they made a neat profit, were not so profitable after all.

Likewise he might also learn why a certain specialty company always seemed pleased to accept their orders for a minor machine part at quite a low figure, for the reason that they had long ago discovered that the class of machine on which this part could be made carried an overhead considerably below the 250 per cent that his own plant assumed in computing its cost on this piece.

Another item that affects the cost in some shops is the poorly selected, though extensive, equipment to handle the work in question. No one can gainsay the advantage of adequate tools and equipment that play such an important part in modern production methods, but on the other hand we cannot shut our eyes to the numerous cases of unnecessary and superfluous equipment for minor operations, the cost of which must be tacked onto every unit produced and eventually paid for by the customer.

Another place which contributes its share towards excessive costs, but in a quiet, unobtrusive manner, is the stockroom. Aside from the stocks of parts which represent a legitimate quantity needed for production there are in every stockroom more or less parts to be used for service only, some of which represent from five to fifty times the actual number that will ever be needed to service that particular part.

What is the cause of this surplus stock and what department is responsible? In a majority of cases the part has been superseded by a new part, incorporating some improvement or correcting some fault that had been reported in service. The change has been made, however, without a careful survey of the number of old parts in finished and rough stock, or in process.

One way of lessening the tendency to overstock as a result of such changes is to insist that, before any proposed change can be brought up for consideration, the following information be placed on the change sheet: (1) Number of parts in finished stock; (2) number of parts in process; (3) number of parts in rough stock; and last but not least, (4) number of parts which the purchasing department may have on order, if it is a part that is purchased either rough or finished from outside sources. This information has a decidedly healthy effect in preventing the engineering department, in a burst of enthusiasm, from crowding through changes without a thorough investigation of the stock and just what the change may mean from a dollar-and-cents standpoint.

Another cause that is often responsible for an excessive number of certain parts in service stock is the elimination of a model without taking the proper steps to balance up the stock of the various parts and comparing them before taking the model in question out of production. The service requirements on a certain model may be such that 75 per cent of the parts are seldom, if ever ordered for replacement.

Some of the suggestions offered above appear to be of a rather elementary nature, as one would imagine that the status of the stock would always receive careful attention, but a walk through the service stockrooms of the majority of our large manufacturing plants, especially those engaged in automotive work, will show that no small portion of their costs are in the form of "frozen assets" in stock.

It may sound presumptuous to intimate that our modern managers have not already given all the above items due consideration, but it is a fact that many of them have not done so. Having arrived at the bare labor cost on a part, they are content to add whatever overhead seems applicable to that class of work and let it go at that.

The selling expense of some products plays an important part in the selling price of them. The percentage received by dealers on some classes of work, such as road building and contracting equipment, run as high as 30 per cent. It must be remembered that the dealer expects to do a certain amount of servicing on this class of machinery, but even allowing for this, the purchaser of a piece of equipment at six or eight thousand dollars must realize the weakness of selling methods that exact such a heavy toll from the buyer.

In regard to the position that labor costs govern costs consider a certain make of safety razor that sold for $5 all over the country for many years. Within the last few months this same make of razor, made by the same company, can be purchased for 86 cents. Did the labor costs in this particular product undergo some phenomenal reductions, or was Mr. Einstein's exposition of the theory of relativity responsible for the reduction in price?

The Law of the Involute Curve

Determining the Lead of an Involute Curve—How Right- and Left-Hand Involutes May Be Generated—Finding the Length of Involutes

BY O. G. SIMMONS
Vice-President and General Manager, Simmons Method-Hob Company

WHAT IS AN involute curve? The writer, like many others interested in gearing, asked this question some twenty years ago. The question was answered then and is answered by many today in terms of method of procedure, somewhat as follows: Cut a circular disk from a stiff card and tack it fixedly to the drawing board. In the edge of the circle stick a pin. Attach a thread to the pin and form a loop at the other end. Wind the thread about the circular edge of the disk, pass a pencil point through the loop, and then unwind the thread with the pencil, keeping it stretched taut. If the pencil point is pressed to the paper, meanwhile, it will describe an involute curve on the board.

This was the only answer and made one no wiser after having received the information than before. Evidently it has been due to this lack of knowledge of what the characteristics of an involute curve really are that the art of gearing has been shrouded in such mystery and that authorities on gearing have been at variance regarding this particular matter of the involute.

Up to the present time, the manufacturer has been cutting the gear teeth for his product with such cutters as happen to be on hand and supplied him by the manufacturers of machine tools for generating or forming gear teeth. His interest usually has ceased upon the discovery that the theories of the authorities on gearing were complicated and this notwithstanding his realization that his gears were not giving the sort of service that modern practice demands. The manufacturer has been compelled to cut gears with such cutters or tools as were supplied him, submitting to fate and accepting the indifferent results without question.

Modern demands on machine elements, however, induced by such inventions as high speed steel, the automobile and the steam turbine are such that the manufacturer who uses gears in his machines must provide the best gears within the scientific knowledge of himself or his associates. The writer will attempt in the following pages to supply a part of this knowledge and will begin by answering the question: What is an involute curve?

In proving that the involute curve has a lead like the helix, reference is first made to Fig. 1. The numeral *1* indicates the shaft upon which is mounted the pulley *2*. To this pulley there is secured rigidly a piece of cardboard *3*. which rotates with the pulley. To the left of the shaft *1*, is located another shaft *4*, upon which is mounted a pulley *5*, similar to the pulley *2*. A belt *6* is mounted upon the pulleys *2* and *5* so that the movement of the belt will rotate the pulleys. To the belt *6* there is fixed a holder *7*, adapted to receive a marker or scriber *8*, the point of which lies in the plane of the belt *6* and to which the circles *2* and *5* are tangent.

The point of the scriber *8* is placed in contact with the cardboard *3*, and the belt *6* is moved in the direction of the arrow *U*, over a distance equal to the perimeter of the pulley or circle *2*, and the movement is then stopped. The involute curve *9* has been generated and drawn upon the card *3*, while the pulley *2* has made one revolution in the direction of the arrow. The shafts *1* and *4* have been supported at a sufficient distance apart *V* to permit cardboard *3* to turn freely.

Since the point of the scriber has been moved along the tangent line represented by the belt *6*, over a distance equal to the perimeter of the pulley *2*, the distance

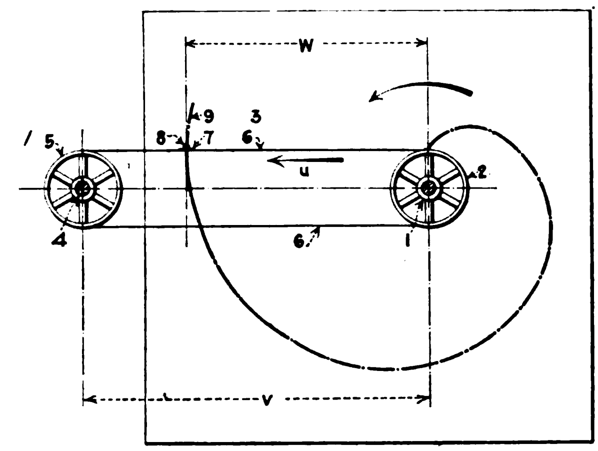


FIG. 1—INVOLUTE CURVE GENERATED BY PULLEYS AND BELT

W represents the "lead" of the involute as well as the perimeter of the pulley *2* which is the evolute of the involute curve *9*. It is obvious that for each distance *W* the scriber *8* moves, the pulley *2* will make one additional revolution. It follows, therefore, that the sum of all the distances *W* will equal the perimeter of the pulley *2* multiplied by the number of its revolutions.

From the foregoing illustration and description, the truth of the law of the involute curve will be apparent. The law may be stated as follows:

The involute of any evolute has a constant lead which, when measured on a line tangent to the evolute, is equal to the perimeter of the generating evolute.

The truth of this law has only been demonstrated in connection with an evolute in the form of a circle, for we are concerned only with the involutes of circles. These circles are the evolutes of the involute gears, as we shall later consider. It is to be understood, however, that the law of the involute can be demonstrated to hold true with an evolute of any form.

The theory illustrated in Fig. 2 is very similar to that in Fig. 1, except that in Fig. 2 we have interposed an intermediate pulley to which we have fastened the cardboard and upon which we shall generate right- and left-hand involute curves. A pulley *10* is mounted upon a shaft *11* and is adapted to rotate with or upon it. Another pulley *12* is adapted to rotate with or upon a shaft *13*. Joining these pulleys is a belt *14* which rotates the pulleys when it is moved. Between these pulleys, and engaging the belt *14*, is located a third pulley

15, adapted to rotate upon its shaft *16* when the belt *14* is moved.

A piece of cardboard is rigidly secured to the intermediate pulley *15*, so as to turn with it. A scriber X is placed at the point of origin or the point of tangency of the belt *14* with the pulley *15*, as in the case of Fig. 1. The belt *14* is moved in the direction of the arrow *1*, with the scriber in contact with the cardboard. The scriber X then generates the involute curve *1*, with a lead which the perimeter of the pulley *15* equals.

For the purpose of these abstract demonstrations, the belt is assumed to be imaginary only and without thickness. In a practical apparatus using belts, the thickness

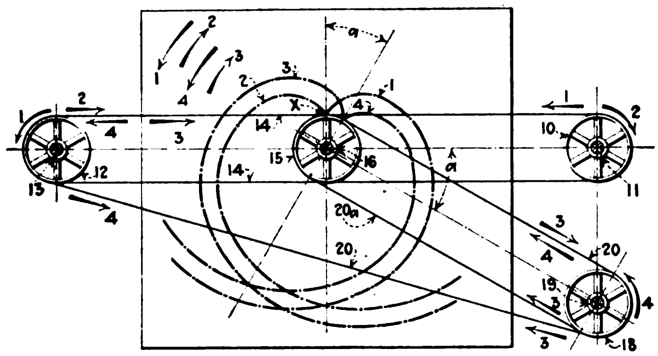


FIG. 2—RIGHT- AND LEFT-HAND INVOLUTES GENERATED FROM TWO POINTS OF ORIGIN

of the belt must be added to the diameter of the pulley and this sum would be the real diameter of the evolute, the perimeter of which would equal the lead of the involute. The reasons will be obvious later when we describe the method of generating involute curves in lathes, milling machines and similar machine tools.

The operation just described is identical with that described in connection with Fig. 1. If the pulley and cardboard are turned in the opposite direction, as indicated by the arrow *2*, the scriber X will generate an opposite hand involute curve *2* from the same point of origin. The lead of this curve will be equal to that of the involute curve *1*, for the reason that all involutes of equal evolutes or circles are equal.

We will now introduce still another pulley which is indicated by the numeral *18*. This pulley is located at an angle α below the pulley *10* and rotates with or upon the shaft *19*. A belt *20* is arranged upon the pulleys *12*, *15* and *18*, and the belt *14* is removed. To insure correct turning, another belt *20a* may be placed upon the pulleys *15* and *18*. The scriber X is placed in the same position as before and generates the involute curve *1*, when the belt *20* is moved in the direction that the arrow *4* indicates.

The movement of the belt *20* is reversed to move in the direction of the arrow *3* and the scribing point X, not having been changed, returns along the involute curve *1*, to the point of origin, where it ceases to generate. The point now lies upon and coincides with the circular surface of the pulley *15* until it has moved through an arc represented by the angle α, to a new origin. Upon continued movement of the belt in the direction of arrow *3*, the scriber then generates from the new origin the involute curve *3*, as the cardboard is rotated with the wheel *15* in the direction that the arrow *3* indicates.

It is now evident that the involute curve *1*, during the rotation of the cardboard, will take the position of the involute curve *4*, at the moment the scriber X begins to generate the involute curve *3*. When this movement is reversed to the direction of the arrow *4*, the scriber X generates the involute curve *4* from the same point of origin and the curves *4* and *1* coincide.

In this view, the involute curves *1*, *2*, *3* and *4* have been shown in different positions with respect to the cardboard and as being generated from two points of origin. This has been accomplished by indexing the cardboard through the angle α. From the foregoing description of the principles of movement illustrated by Fig. 2, it is apparent that all involute curves from the same circle, when of the same "hand," either coincide or are parallel to one another. Further, it is also clear that all right-hand involute curves, and all left-hand involute curves, generated from the same circle, but from different points of origin, are parallel.

From an inspection of Fig. 2, it will be clear also that if two scribers were used and placed upon the belt at a distance apart equal to the arc on the periphery of the wheel *15*, determined by any angle α, two involutes would be generated if moved one way and two of the opposite hand when the action was reversed. No reversing action would be necessary to generate a right- and left-hand involute curve, one after the other, if the scriber X in Fig. 2 were placed in contact with the cardboard at a point removed from the point of tangency of the belt and if the intermediate pulley and the belt were moved so that the scriber would approach the point of tangency. The scriber would then generate an involute, and upon leaving the point of tangency, with the same movement of the belt continued, would generate an opposite hand involute.

The position of the intermediate pulley with respect to the outside pulleys is of no moment in so far as the point of origin of the involute curves is concerned. The point of origin of an involute curve is at the point of tangency. The involute curve cannot possibly extend below the evolute or generating circle since the tangent line is the line of rectilinear movement, which line is tangent to the evolute. A point, such as the scriber, must have not only a certain definite movement but also

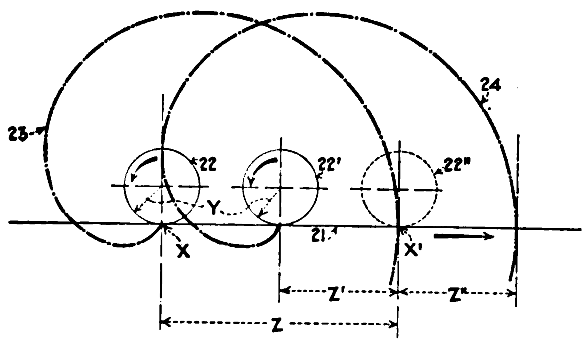


FIG. 3—INVOLUTES GENERATED BY PULLEY ROLLING ON A PLANE

the movement of such a point must be along and on the line tangent to the evolute. This line we have just defined as the line of rectilinear movement.

With reference to Fig. 3, the numeral *21* indicates a plane upon which is adapted to roll, without slippage, a circular disk *22*. A cardboard (not shown) is attached to the disk in the manner previously described and at the point X' on the plane *21*, the scriber is placed. The circular disk *22* is placed so that the plane

21 is tangent to it at the point X', represented by the dotted circle *22*." The disk is rotated from that position in the direction of the arrow to the position of the circle *22*, which represents one revolution of the disk. The involute curve *23* has been generated but the plane and the scriber have remained stationary.

If the disk *22* has a radius equal to Y, it is obvious that the distance measured on the plane *21* between the point of the origin X and the point of the scriber X', which is represented by the letter Z, will equal $2Y \times 3.141592$. Again, the disk *22* is placed as before to represent the circle *22*" and the latter is rotated to the position *22'*, while the plane *21* has moved in the direction of the arrow. The involute curve *24* is generated.

This principle, however, to which we referred previously when we considered the belt in Fig. 2, is dependent upon the condition that there is no slippage between the disk and the plane but that the movement is absolutely according to the ratio of lead over the perimeter of the disk. In other words, the disk must, for every revolution it makes, be just that many perimeters away from the generating point, regardless of its linear movement.

This principle is also shown in Fig. 3. In the last case described, the disk *22'* has rolled to the position shown from its original position at *22*", and has made a complete revolution, while its linear movement represented by the letter Z' along the plane *21*, means but a part of the actual distance Z. In this case, let us assume this distance equal to one-half of Z, so that: $Z' + Z'' = Z$. Evidently the combinations of relative movements between disk and plane are unlimited.

The word lead has been used herein to distinguish between the pitch of the involute and its lead for one turn of the generating circle. The pitch will be equal to the perimeter divided by the number of involutes generated from the same circle. Expressed as a formula:

N = number of involutes divided and generated from the same circle
P = pitch
L = lead

$$P = \frac{L}{N}$$

A formula for the length of the involute curve of any circle, measured along the curve from its point of origin to the generating or marking point, for one revolution of the evolute, may be expressed as follows:

X = length of the curve for one complete spire
L = lead of the involute
D = diameter of the generating circle
N = number of spires to the involute curve
π = 3.141592

$$X = (N\pi)\ (NL)$$

$$D = \frac{X}{(N\pi)^2}$$

It is evident, of course, that by transposition we may determine any of these factors.

As the foregoing principles applied to the generation of an involute curve are true, we may give a correct definition of such a curve as follows:

The involute curve is the resultant of the uniform movement of a point along a straight line tangent to a given circle and the angular movement of the line about the periphery of the circle uniform with the movement of this point and over an arc equal in length to the distance traversed by this point.

(To be concluded)

Research and Lubrication

The following paragraphs are from Research Narrative No. 44 issued by the Engineering Foundation. The contents are based upon information from Dr. Irving Langmuir, General Electric Company Research Laboratory, Schenectady, N. Y.

How large are molecules and what are their shapes? The layman frequently expresses incredulity as to practical usefulness of the refined and abstruse work of scientific research. Such incredulity is found even among technical men and other persons whose occupations or fortunes are built upon the sciences. Attempts to solve problems whose industrial importance needs no explanation, often are unsuccessful until Science has gone far toward the "root of the matter."

A modern method for separating copper and certain other metals from some kinds of ores is known as the flotation process. Finely pulverized ore is mixed with water containing a small quantity of oil which forms a persistent froth upon agitation. The solid particles of ore are wet with the oil and these oiled particles adhere to the bubbles of froth. Thus the ore particles float to the top of the tank containing the mixture while the non-metallic particles of the ore, not being wet by the oil, do not adhere to the froth and fall to the bottom of the tank. The remarkable selective action of some oils on certain ores and the effects produced by small quantities of acids and other substances are imperfectly understood.

Some experiments undertaken by Dr. Irving Langmuir in the General Electric Laboratory at Schenectady, have led to the determination of the sizes of molecules of a number of substances and to the proofs of the fact that molecules could not be merely smooth, rigid spheres. It appeared that the dimensions of some molecules differed, the length, for example, in some cases, being several times the square root of the area of the cross-section. It was also evident that the active atoms, or groups of atoms, in certain molecules of a liquid when spread upon the surface of a solid or another liquid, turned in the direction of the surface of contact so as to engage the atoms or molecules in the supporting surface. This knowledge helps to explain why certain liquids will wet each other, and certain solids, but not others—in other words, will spread in a uniform film over the whole surface of contact.

These experiments were undertaken solely because of their scientific interest. Only later was it realized that they had an important bearing on the process of flotation.

These phases of the subject, it will readily be seen, are of importance also in the very practical problem of lubrication, of interest to everybody who runs a machine of any kind. For in order that he may have sold to him the right kind of lubricant, or in order that expensive machinery may not be injured, those who manufacture the lubricants should have the benefit of the chemist's and physicist's knowledge of the fundamental principles developed by such research as that of Dr. Langmuir.

But how big is a molecule? To use as an example a commonly known substance, a molecule of castor oil has a cross-section in square centimeters expressed by the fraction having 209 for its numerator, and 1 with sixteen ciphers after it for the denominator; its length in centimeters is 5.5 divided by 1 with eight ciphers;—almost too small to be conceived.

TABLE III

United Kingdom—Exports of Metal Working Machinery

Period—1908 to 1921, Inclusive

Country	1908	1909	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
Austria-Hungary	£9,431	£1,845	£10,405	£11,980	£11,344	£10,632	£3,867	£......	£......	£......	£......	£......	£......
Argentine Republic	23,868	61,514	39,722	41,952	36,230	30,574	21,614	4,525	5,642	2,881	3,894	14,510	42,593
Belgium	7,091	14,962	22,589	23,336	36,042	32,128	17,373	......	......	40	......	203,413	272,014
Brazil	16,340	36,488	33,410	44,460	70,482	57,734	28,447	5,721	4,421	3,223	5,864	21,328	54,580
Chile	12,275	13,450	8,587	14,865	13,292	17,101	7,634	1,340	1,128	1,960	2,149	8,927	8,540
China, Exclusive of leased territory	......	......	......	......	......	......	......	......	......	......	......	......	82,693
Denmark	......	......	......	......	......	......	......	......	......	......	......	......	9,113
France	25,409	60,727	72,606	55,080	85,966	142,127	92,971	192,962	363,031	847,361	693,385	771,235	607,444
Germany	10,706	14,928	23,471	25,742	48,545	45,998	18,290	......	......	......	......	......	13,840
Greece	......	......	......	......	......	......	......	......	......	......	......	......	9,707
Italy	11,500	27,283	124,568	41,904	68,391	68,464	54,629	48,563	115,594	207,686	273,093	234,474	73,160
Japan, Inc. Formosa	110,620	206,524	76,284	104,501	125,078	118,060	97,509	17,424	17,626	26,245	44,098	112,084	232,658
Netherlands	2,691	15,860	9,477	16,887	24,025	17,932	18,973	11,821	7,048	3,677	674	52,960	17,506
Norway	......	......	......	......	......	......	......	7,647	6,510	7,093	2,338	19,931	......
Portugal	......	......	......	......	......	......	......	1,847	6,163	8,426	8,673	37,199	38,882
Russia	8,063	28,741	27,076	59,095	54,510	85,021	272,817	273,101	377,513	804,175	......	30,869	23,702
Siam	......	......	......	......	......	5,885	15,368	1,326	3,066	2,385	1,777	4,054	9,306
Spain	7,171	15,380	19,230	11,498	17,257	20,585	18,628	15,062	17,285	20,669	22,091	94,297	154,921
Turkey	......	......	......	......	......	......	......	......	......	......	......	......	7,561
United States of America	......	......	......	......	......	......	......	2,335	3,728	4,730	17,483	18,852	18,413
Other Foreign Countries	33,860	62,081	61,196	75,487	72,343	76,671	71,333	44,931	21,479	24,999	20,008	99,053	201,405
Total Foreign Countries	£279,025	£559,783	£528,621	£526,787	£663,505	£728,912	£739,453	£628,605	£950,234	£1,965,550	£1,095,527	£1,723,186	£1,878,038
Australia	£29,791	£46,333	£65,143	£99,946	£107,854	£115,842	£87,413	£47,341	£54,243	£54,186	£45,778	£117,905	£296,640
British East Indies	69,491	107,998	42,596	64,238	78,400	89,239	94,807	58,317	68,608	64,945	80,386	278,854	840,710
British West Indies	......	......	......	......	......	......	......	......	......	......	......	......	4,262
Canada	4,448	5,410	16,564	16,557	25,192	24,804	35,461	12,230	5,322	4,006	14,667	29,514	6,845
Ceylon	......	......	......	......	......	......	......	......	......	......	......	......	6,213
Egypt	......	......	......	......	......	......	......	2,716	4,273	5,169	12,314	9,700	10,257
Federated Malay States	......	......	......	......	......	......	......	......	......	......	......	......	4,945
Hongkong	......	......	......	......	......	......	......	1,593	5,374	1,364	1,706	31,894	79,541
New Zealand	13,130	10,239	19,334	14,315	18,877	13,726	16,078	9,836	6,737	4,287	3,250	17,891	39,260
Straits Settlements	......	......	......	......	......	......	......	......	......	......	......	......	13,376
Union of South Africa	4,564	15,763	27,013	27,124	22,479	22,820	25,870	12,361	10,218	5,666	17,171	46,911	95,776
Other British Possessions	15,932	22,959	15,333	10,523	18,634	17,457	21,105	6,485	11,849	6,504	9,537	29,711	85,499
Total British Possessions	£137,356	£208,702	£185,983	£232,703	£271,436	£283,888	£280,734	£150,879	£166,624	£146,127	£184,809	£562,380	£1,483,324
Total	£416,381	£768,485	£714,604	£759,490	£934,941	£1,012,800	£1,020,187	£779,484	£1,116,858	£2,111,677	£1,280,336	£2,285,566	£3,361,362

Value of £ at parity is $4.8665

TABLE IV

United Kingdom—Imports of Machine Tools

Country	1908 Quantity Tons	1908 Value £	1909 Quantity Tons	1909 Value £	1910 Quantity Tons	1910 Value £	1911 Quantity Tons	1911 Value £	1912 Quantity Tons	1912 Value £	1913 Quantity Tons	1913 Value £	1914 Quantity Tons	1914 Value £
Germany	.....	....	71	7,093	83	8,603	221	14,943	163	13,750	218	20,450	429	31,337
Belgium	....	....	22	1,356	31	1,647	42	1,522	35	1,920	24	1,452	.....	....
France	.....	....	20	1,275	24	1,403	23	1,492	56	2,719	34	2,902	44	3,263
United States of America	798	99,014	476	68,293	397	66,078	1,488	192,863	2,448	260,100	3,411	324,832	4,162	376,605
British Possessions	.....	119	1	53	4	237	3	125	.....	34	12	978	41	2,892
Other Foreign Countries	189	16,494	39	3,085	32	4,010	38	3,274	43	4,120	153	10,826	157	12,952
Total	987	115,627	629	81,155	571	81,978	1,815	214,219	2,745	282,643	3,852	361,440	4,833	427,049

Country	1915 Quantity Tons	1915 Value £	1916 Quantity Tons	1916 Value £	1917 Quantity Tons	1917 Value £	1918 Quantity Tons	1918 Value £	1919 Quantity Tons	1919 Value £	1920 Quantity Tons	1920 Value £	*Number of Pieces
Sweden	......	....	......	....	......	....	......	....	......	....	315	57,730	397
Germany	......	4	1	43	1	57	......	....	10	1,869	685	119,237	1,153
Netherlands	......	....	......	....	......	....	......	....	......	....	96	20,923	238
Belgium	......	....	......	....	......	....	......	....	......	....	36	8,413	43
Denmark	......	....	......	....	......	....	......	....	......	....	360	59,773	451
France	37	3,452	52	7,860	37	8,194	16	3,339	67	14,761	298	48,648	717
Switzerland	......	....	......	....	......	....	......	....	......	....	76	24,641	371
United States of America	20,465	2,099,076	21,443	2,849,281	15,645	2,616,286	19,088	3,771,994	16,630	3,860,979	10,839	2,576,073	13,092
British Possessions	88	11,914	225	22,160	43	7,793	93	40,427	94	15,770	105	23,272	116
Other Foreign Countries	152	13,937	262	32,402	134	22,495	182	42,504	297	69,097	458	81,332	1,399
Total	20,742	2,128,383	21,983	2,911,746	15,860	2,654,825	19,379	3,858,264	17,098	3,962,476	13,268	3,020,042	17,969

1921—figures showing imports of metal working machinery by countries are not yet available.
The gross amount imported was 3,012 long tons, valued at £632,205.
*The number of pieces was not shown prior to 1920. The 1920 statistics show the various classes of metal-working machinery, such as Drilling and Grinding Tools, Lathes, Milling, Planing and Shaping machinery, Presses, Punches, Shearers, and parts. Prior to 1920 the enumerated classes of machinery were classified under the general heading "Machine Tools."

Johnson's Plan for Buying Special Machines

BY JOHN R. GODFREY

I was in Johnson's office not long ago while he was making a deal for a new machine. His bargain with the maker, his line of reasoning, and his effort to be fair to the other fellow were so unusual in the buying of machinery that I am going to pass them on for the careful consideration of the readers of *American Machinist*. It seems that there had been a few interviews before but this summed them all up and the machine builder got a real thrill, if his actions were any indication of his feelings. Johnson did most of the talking, as usual, but as long as he hands out some real dope, I'd rather listen anyhow.

"So you think you've got a plan for that special machine for drilling our cylinder blocks at one setting. That's what I've been after for some time Mr. Brown. Now if we can get together on price, we'll be cutting our drilling cost into mincemeat in a few months. I know it's a delicate subject, on special machines, but spit it out so we can get busy discussing it."

"Mr. Johnson, I'm afraid our price will seem high but there's a lot of work designing such a machine. It upsets our regular shop routine even if we are not very busy just now and it isn't likely we shall ever build you more than one machine. That's the trouble with building special machines that have such great productive capacity. We've figured it down pretty close because we need the work and ——."

A BACKBONE STIFFENER NEEDED

"Now, Mr. Brown, let's stop talking price a minute and let me get a few things off my chest. I've been thinking a lot about this machine and a few others I want built, and I've a notion we can get together on a new basis. Some of you machine builders have been highway robbers but most of you need to put a stiffening compound in your backbone when it comes to special machinery. If course I know I ought not to tell you this 'til after I've squeezed you down to the last penny, if at all, but my durned old New England conscience, or what passes for it, got to working awhile ago and I've got to tell you how I feel. I thought I had it pretty well chloroformed but it came to life again last week. I'm afraid it will cost me real money. But it simply won't stay quiet. So here goes.

"I sent for you awhile ago, told you our problems and gave you a blueprint with a flock of holes shown on a cylinder block. Looked like a bum target made by a load of buckshot. Using this to shoot at you've dug into the past experience of your whole outfit and designed a machine that will do the work in twelve seconds according to your estimate. That probably means ten seconds when we get it limbered up because I've always noticed that you play safe in such matters, and I like you better for it.

HOW CORLISS GOT HIS

"I don't know how you figure your price, whatever it is, but I'll bet it isn't enough to let you out whole and pay any return on the capital you've invested in the way of brains. And the deuce of it is I probably can't afford to pay what it's worth in cold cash right off the bat. So I'm going to tell you first a bit of history and then make you a proposition.

"You know something about the Corliss engine even if most of them have become ancient history. But they were new once, so new and so costly that it wasn't easy getting orders for them even in the face of their proved economy. So George Corliss doped out a form of contract by which he took his money out of the savings in coal over the engines he replaced. He charged a good price for his engines, as he should, but he made even the tightest wad in the cotton mill business pay for it out of the savings in fuel.

"So here's my proposition to you, Mr. Brown. You make me a price which covers material, labor, overhead and a fair profit, a usual profit on a standard machine. Cut off whatever you have tacked on for brains and know-how in getting out this machine. Then we'll make another contract that will give you ten per cent of the net saving on the work done for five years, unless the machine is replaced before that time. In other words we pay you cash for the machine and pay you a royalty on the saving due to the brains you put into it and the experience behind it. If the machine saves what you say it will, and I don't doubt it a bit, you'll have a nice little royalty check coming your way every six months. The more it saves the more you get out of it. Sort of puts you on piece work, you see!

REGULAR PRICES PLUS A ROYALTY

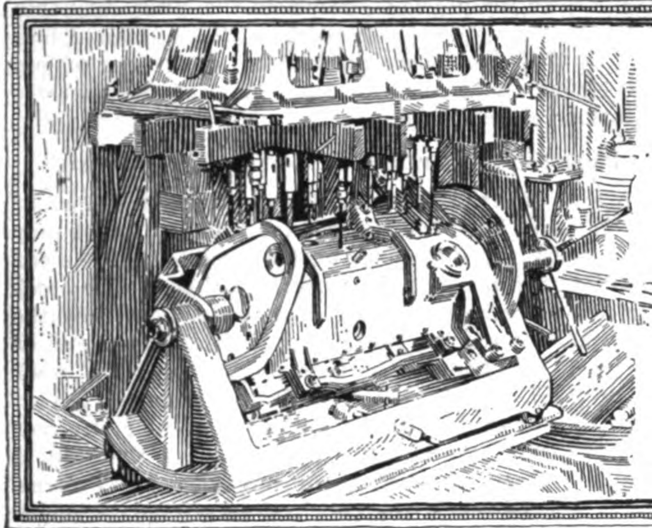
"This is somewhat different from the plan of leasing machines as is done in the shoe business and a few other lines. Don't see how that could work out in such a case as this. Then, too, a manufacturer doesn't exactly cotton to the notion of having leased machines in his shop. Besides it would take more capital than the average builder of special machines could dig up. And I believe the royalty plan is better and fairer. What say, Brown?"

"Say, Mr. Johnson! I'll say, yes, right off the bat. You've sort of given me a real surprise party, and a mighty agreeable kind, too. I've been so used to fighting for a fair price on special machinery that your proposal sort of takes my breath away. It's the fairest plan I've had handed to me yet and you can bet you'll get just the best machine we know how to build."

After Brown had gone out with a face that beamed like a full moon, Johnson turned to me and said, "I suppose my friends who call themselves financiers will say I'm seven kinds of a d. f. or should have some alienist examine me for softening of the convolutions we call brains. But I've studied that special machine business a lot and I don't see anything wrong with my scheme. And if you do, you ought to have shouted before Brown got away."

I'm wondering if Johnson's scheme might not be worked on a number of high production machines, even if they are not special in the true sense of the word. A big first cost almost always acts as a dampener to a buyer's enthusiasm for new machinery, especially when a board of directory has to pass on the purchase. Seems to me it would make it much easier to sell a big, highly organized machine that we now have to sell at a very high price. Think I'll suggest it to Johnson the next time I see him.

Of course there is always the question of whether or not the other fellow will play the game squarely. But we usually find that the man who doubts it will bear watching himself. It's mighty easy to suspect the other chap of doing what we might be tempted to do ourselves. If the great majority of men were not honest we'd have a hard time doing business in almost any line.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Bending Dies Continued—Progressive Piercing, Blanking and Bending—Design of Strippers and Plungers—Closing-in Devices—Double Bending Dies

IN CERTAIN kinds of bending operations it is necessary to use a punch and die with guide pins of the sub-press type. The expense is not always warranted, however, and when this is the case small dowel pins may be used to answer a similar purpose. An example of this kind is shown at *A* in Fig. 473. Here the work *B* is formed with a radius having two flat portions at each end as indicated. The die *C* has two aligning pins *E* assembled in it so that they fit the two holes *F* located in the punch. This arrangement permits the punch and die to align themselves accurately, yet they are also held rigidly while the operation is taking place.

In the example *G* the work is somewhat irregular, yet the operation of bending is performed at one stroke of the press. The work is laid on the die and the punch strikes it, making the form shown. It is unnecessary for the punch and die to cover the entire length of the stock being bent, as it is permissible to have the stock project over the ends of the punch or above the edge of the die as indicated. In the example *H* a punch and die are shown for bending a rectangular piece. The small bends at *K* have been previously made in another operation, and the bends *L* are to be made in the die shown. This is a very simple bending operation which requires no lengthy description. The example *M* shows a simple method for bending a square piece of work. The ends here have also been bent in a previous operation and this punch and die are used for the final operation. In the example *N* the last operation completes the work and forms the blank into a complete square. The punch in this case has a projecting form *O*, and as the punch rises from the die the work is withdrawn with it.

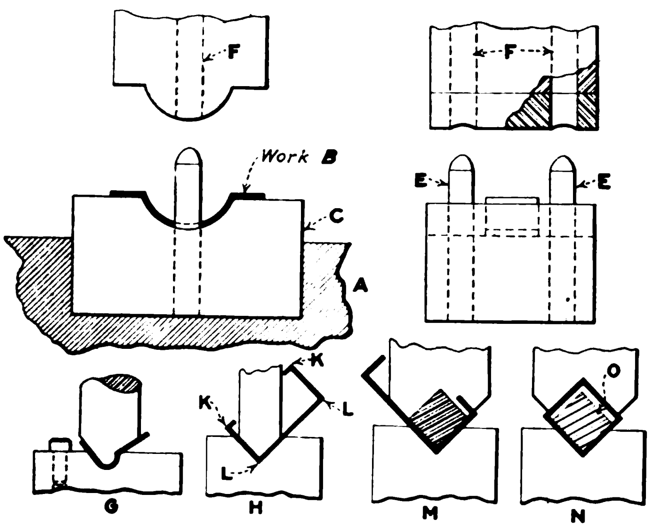


FIG. 473—EXAMPLES OF BENDING OPERATIONS

Strippers and Plungers for Bending Dies

A bending die may often require a stripper or spring plunger in order to assist in removing the work after it has been bent to the desired form. Fig. 474 shows at *A* a die of this kind having an ejector *B*. As the punch carries the work down into the die this plunger is forced downward until it reaches the bottom, at which time it is so located that it acts as a part of the die itself in forming the work. When the punch recedes, the plunger springs up and ejects the work. Another type of die having a plunger which acts as an ejector is shown at *C*. This die is for bending a piece of work into U-shape, and the die is arranged so that as the punch *D* strikes the work it carries the plunger *E* down with it until it locates on the surface *F*, thus forming the bottom of the die. When the punch rises from the die the work is forced upward by means of the plunger, which is restrained in its movement by the screw *G*.

The location of any piece of work in a bending die is of great importance, as any inaccuracies in location will result in uneven bending. There are many forms of locating pins and plates for work, and these forms vary according to the shape of the part which is to be bent. At *H* a die is shown for producing the part shown at *K*, the work in this case fitting the upper part of the die and locating against the plate *L*. The location of a plate of this sort is often difficult to determine, as the amount of stock drawn down when the bend is being formed is likely to vary. For this reason it is a good idea to make up a few trial blanks before locating the stop permanently, in order to make

sure that its position is correct. The type shown at *L* is a stripper stop which is fastened to the top of the die by the two screws indicated. These stops are often held in position by dowels when accuracy is essential. The height of the space is not particularly important, and it can be thicker or thinner than the stock providing there is no interference with the punch.

Another method of locating work for bending is

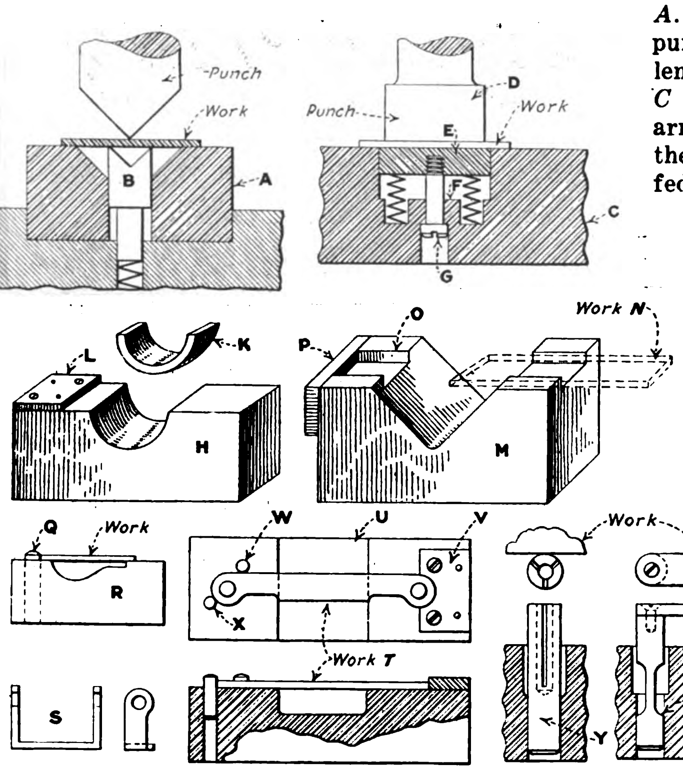


FIG. 474—METHODS OF LOCATING WORK FOR BENDING OPERATIONS

shown at *M*. The work *N* fits a slot on the top of the die, which is cut out as shown at *O* to the thickness of the stock. The stock is positioned by striking against the plate *P*, thus locating it correctly for the bending operation. In the example *R* a pin *Q* is used for obtaining the proper end location. This is a very simple method of locating, and it has been found satisfactory for a great proportion of work.

In the example at *S* the work has two bends at right angles, thus forming the stock into U-shape. This example is slightly more complicated than those previously shown, the blank being located at one end in a nesting plate *V*, while at the other it strikes against two pins *W* and *X*. The sectional view of the die shows the position very clearly. There is a point of importance which must be mentioned in connection with the location of work of this kind between positive locating points. This is the variation in the length of the blank which is likely to occur after blanking dies have been in use for some time. The variation is often due to the spread or enlargement of the opening in the die.

If great accuracy is required it is necessary to provide for this variation in the size of the blank by using a permanent rest at one end of the work, while the other may be located against a spring pin similar to that shown at *Y*. This pin is provided with three slots and has a hole drilled in it. It is pressed into the die as shown, and a counterbored hole slightly larger than the pin permits the latter to spring to take care of various lengths of stock. Another type of spring pin is shown at *Z*. Here the pin is cut down so that it is very thin at the center and it is pressed into a counterbored hole such as that previously mentioned. This type of pin will spring sufficiently to take care of considerable variation in the blanks.

Progressive Piercing, Blanking and Bending

In Fig. 475 is shown a die for producing the work at *A*. This die is of the progressive type, as it not only punches the hole *B* and cuts off the stock to the required length, but also bends the work into shape. The stock *C* is fed into the die in the direction indicated by the arrow until it reaches the correct position at the end of the block *D*. The hole is then punched and the stock fed forward until it strikes at *E*. An enlarged section of this locating point is shown at *F* in order to make the matter clear. As the ram is brought down the forming punch *G* forms the blank, the punch *H* cuts it off to length and punch *K* pierces the hole. The amount of stock that the punch *H* cuts out is the only scrap produced.

It will be noted that the die *E* is provided with a spring pin *L* which forces the work out of the die after the piece has been formed. This ejector occasionally sticks and does not work smoothly, and as it is placed in the die in order to insure the safety of the operator, it is well to caution him not to use his hands in removing the work. If the part should stick and not come out properly, a piece of wood can be provided as an ejector. A die of this sort is adaptable to an inclinable press, so that the finished parts will fall out on each stroke of the press and will not require the use of an ejector.

Very often the shape of the work being formed is such that it is smaller at the upper part or opening than it is at the bottom or forming part. When this is the case it is necessary to bend the work in a die having members which close in and form it to shape. There are many devices used for this kind of a bending operation, and they are operated in several different ways. In Fig. 476 a piece of work is

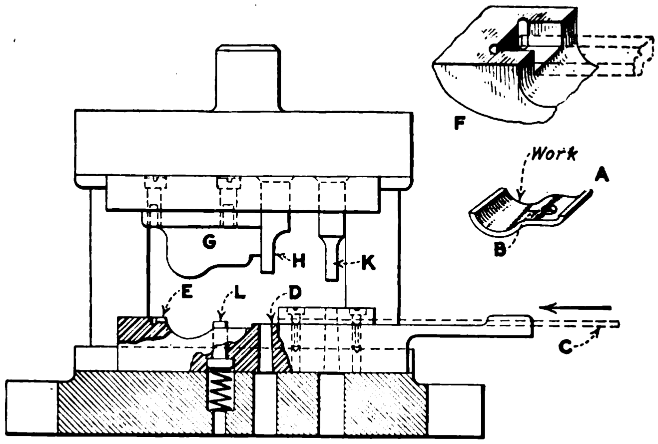


FIG. 475—COMBINATION BENDING AND PIERCING DIE

shown at *A* which is smaller at the upper than at the lower end. Therefore a plain bending die would not give the desired results, and it is necessary to design a die of the closing-in type.

Two methods of forming this piece are shown in the illustration. In the first of these the work *B* is the

blank which rests on the two arms *C* and *D*. The punch strikes the work in the center and carries it down so that it is partially formed, at which time the punch *E* strikes the surfaces *F* on the two rockers and carries the forming plates *C* and *D* down until they strike the bottom of the die *G*. In the example *H* the die is

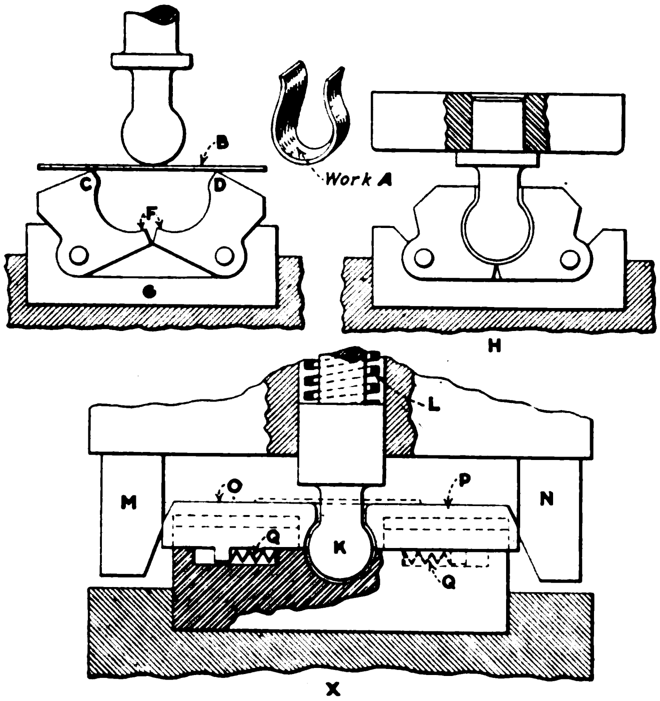


FIG. 476—TWO EXAMPLES OF CLOSING-IN BENDING DIES

shown in the closed position, and it can be seen that the work has been completely formed. As the punch withdraws, the two plates open up while the blank remains on the punch. It can be very readily removed from the punch and the next blank placed in position.

In this example, the parts *C* and *D* are so made that when the punch first starts to supply pressure on the blank, the pressure produced by the blank is outward and does not tend to close the die until the punch has reached the surface *F*. Some forms are so shaped that spring pressure is required to hold the parts up until the punch has entered sufficiently to produce the closing-in action.

Another type of die for the same piece of work is shown at *X*. The punch *K* carries the work down into the die, forming it into U-shape, and after it has struck bottom it is permitted to push up into the punch holder, where it is backed up by a heavy coil spring *L*. As the punch continues descending, the two arms *M* and *N* strike the closing-in forming plates *O* and *P*, thus producing the final form of the work. The angle on the forming plates and arms is determined by the amount of bending required. Care should be taken not to make too steep an angle on these parts. As the punch holder rises, the springs *Q* force the forming plates *O* and *P* out to their normal position and then the work is raised out of the die on the punch, from which it is removed as in the previous example.

Many pieces of work which require bending are of such form that they cannot be made in one operation, and while it is not desirable to use separate dies for the various bends, it is very often practical to construct a die which will take care of several forming operations. Fig. 477 shows two dies of this type. The upper die is used for producing the part shown at *A*. While it would be possible to form this part in a die similar to those shown in Fig. 476, it is sometimes found that the stock is of such grade and thickness that a solid die can be used to greater advantage. In this case the part is laid on the die as shown at *B* and stops against the plate *C*. As the punch comes down, the work takes the position shown by the dotted lines at *D*, and is then carried down into the opening until it is formed as shown at *E*. This example does not show an ejector, although on long bends of this kind one can be provided in order to facilitate the removal of the work.

After this operation the work, shown at *G*, is set over a projecting plug *F*. The plug is supported in the position shown by means of springs and is free to float up and down according to the pressure applied to it. As the punch holder *H* is brought down toward the die, the forming block *K* strikes the work and carries it down until it strikes against the block *L*; and as the die is finally closed the work is formed in the shape shown at *M*. As these dies are closing in, the point N on the block *K* tends to hold the work from springing on the plug *F* when the pressure is applied. At *O* the dies are shown in the closed position. Dies having several bends are often made on this principle, the arrangement being such that on each stroke of the press one complete part is finished.

The dies shown in the lower illustration are used in forming the part shown at *P*. If an attempt were made to bend this part in one operation, the bend is of such irregular shape that the stock would tend to draw unevenly, and it is therefore necessary to use two operations to complete the form. The work is first laid on

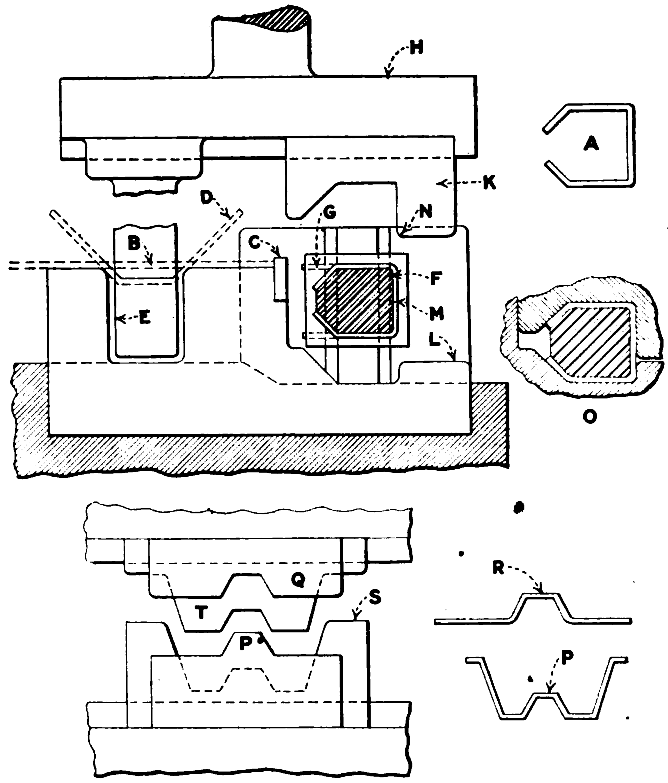


FIG. 477—TWO EXAMPLES OF DOUBLE BENDING DIES

the die, and as the upper forming punch *Q* is brought down, the part is formed in the shape shown at *E*. After this form has been made the work is placed on the die *S*, and the forming punch *T* performs the final operation which produces the part shown at *P*. This type of die is very useful for bending long narrow work, and if desired the stock can be cut off at the same time by providing a suitable punch and die.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Spring Winding by Hand

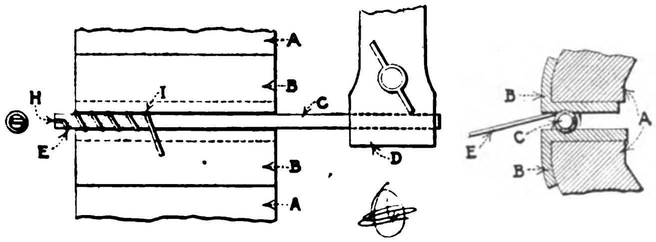
By C. J. Dorer

In the accompanying illustration is shown a novel and extremely simple method of spring winding. Very often it is desirable to have a spring of certain size when a lathe or similar machine, such as commonly used for spring winding, is not available. The method here shown will produce the desired spring of even diameter and pitch.

Procure a rod *C*, of slightly less diameter than the inside of the spring to be made and slot one end as shown at *H*. The depth of this slot should be about three or four times the diameter of the spring wire and wide enough to accommodate it. To the other end of the rod fasten a hand vise, *D*, or a convenient wrench or dog. Place the rod between two soft jaws, *B*, or a vise, *A*, and clamp just tight enough to hold the rod in place.

If soft jaws are not available, two pieces of hard wood, maple or oak, will serve as well. When starting to wind, the slotted end of the rod should be at a point *I* and the slot in a vertical position. Place the end of the wire *E* in the slot and turn the rod a full one-half turn. Then pull the wire toward the opposite end.

When starting the first turn, the wire digs into the jaws and should be steadied by the hand which is doing the turning as there may be a tendency to jerk. At this time the pitch of the spring is determined and the amount the rod is forced ahead on the first turn determines the pitch. From then on the spring threads its way between the two jaws and an even pitch is obtained. After winding, when the jaws are removed, a series of uniform and evenly spaced depressions will



HOW TO WIND SPRINGS BY HAND

be seen on each jaw and, if the vise has not been too tightly clamped, will not injure them for further use.

When fine wire is being used, it is possible to continue turning after the first turn or two without any difficulty. In the case of heavier wire, such as 0.045 in., it is better to open the vise jaws slightly. Otherwise the turning of the rod becomes more difficult as the spring is wound and is apt to snap off the end which is in the slot. The setting of the vise jaws depends entirely upon the size of the wire.

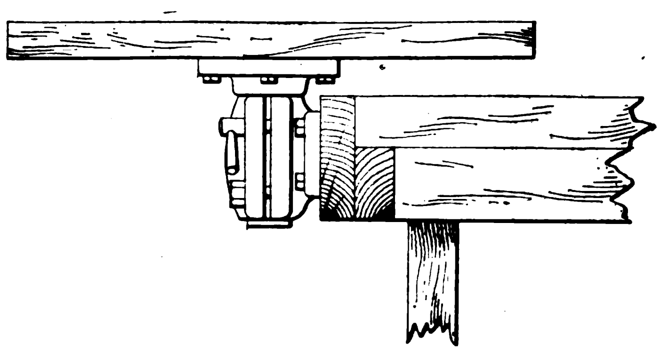
The sighting of the pitch requires a little practice. If the spring is to be close wound, the wire should be held perpendicular over the starting point, otherwise it should be held over toward the crank end of the rod. If a spring of coarse pitch is desired, pressure should be brought to bear on the rod by the hand which is turning it, so as to force it ahead on the first turn or two.

Care should be taken not to let the rod slip. If it does, it is best to start over, but this will not happen if the vise is properly set.

Revolving Table for the Bench

By Joe V. Romig

Any tool or attachment which will lighten a man's labor, will increase his productivity. When a mechanic overhauls or repairs a small machine tool, etc., he usually places it on his work bench and must continually shift his position for the reaching of interior parts, by sliding it around on his bench top. If the machine is heavy or unwieldy, this labor soon tires him out and



REVOLVING TABLE ATTACHED TO BENCH

robs him of his greater work ability. In a small shop the writer once saw the revolving table, shown in the sketch. The mechanic was repairing an old typewriter, and it was a pleasure to see him swing the table around to conveniently reach any part of the work. Assembly work on many small units, and sometimes on heavy parts, can be done profitably by using the same device.

The construction of the table is extremely simple. A flat board of about 1 in. in thickness, makes the top, to which is screwed a 1¼-in. pipe flange, as per sketch. Into the flange is screwed a short section of 1¼-in. pipe filed smooth. The pipe rotates in an ordinary split pillow block, fitted with a clamping handle, by the aid of which the position of the table can be locked when desired. When not in actual use, the table can be pulled out of the bearing and laid away.

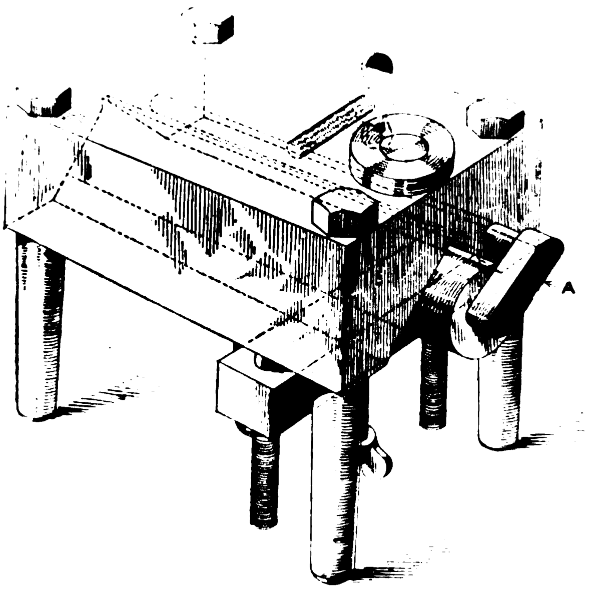
Soliloquies of Old Mac

To hold small round, square or hexagon stock in a large 4-jawed chuck, run two opposed jaws down to the work and then place short pieces of square stock, or tool bits, between the remaining jaws and the work.

Jig for Drilling Cross Holes in Cylindrical Work

By L. E. Schaeffer

The accompanying drawing shows a jig designed by the writer for drilling cross holes in cylindrical work. An important feature of this jig is that the hole for the bushing is in the V-block, and if the jig is correctly



JIG FOR DRILLING CROSS HOLES IN CYLINDRICAL WORK

made the cross hole must be central in the work. There is no way in which the bushing can get out of alignment with the work, as in the case where the bushing is held in a yoke over the top of the jig. The adjustable stop A enables holes to be drilled the same distance from the end in any number of pieces.

Holding a Hammer Head on Its Handle

By Andrew J. Schwartz

Due to a near accident sometime ago I became interested in the methods of holding a hammer head on a handle, and I devised the scheme shown in Fig. 1.

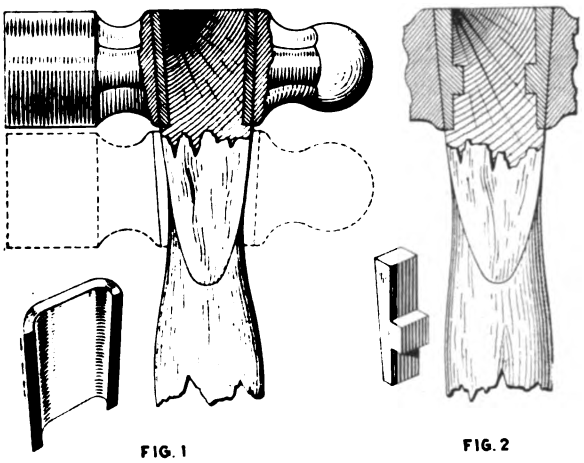


FIG. 1—THE WRITER'S METHOD. FIG. 2—A METHOD PATENTED 40 YEARS AGO

So well pleased was I with the idea that I applied for a patent, but was much surprised when the Patent Office revealed a copy of a patent, Fig. 2, dated about 40 years ago embodying practically the same idea.

In Fig. 1 the eye of the hammer is shown as flaring outwardly and the handle is formed with a correspondingly flaring end. As the dimension of the handle at the widest part is not larger than the smallest opening in the hammer head, the handle may be pushed through the eye as shown by the dotted lines. The wedges are made of sheet steel and fit the inclined sides of the handle and hammer head so that when driven home they make a good fit. Why do not some of our manufacturers make many of the good things on which the patent rights have expired?

Choosing and Grinding Chisels

By G. A. Luers

Normally the mechanic picks out a large or small chisel without considering its purpose, bevels both edges and goes to work on brass or steel. Use a light chisel for brass, where resistance is less and a heavy chisel for steel with its greater resistance. Grind the edge of a chisel used for cutting out brake band rivets, which are copper and have a comparatively shallow head, with a bevel on one side only, as shown in Fig. 1. It will

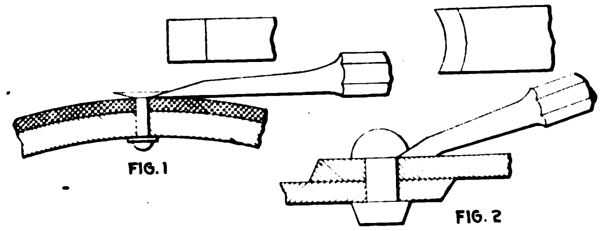


FIG. 1—CHISEL GROUND FOR CUTTING OFF HEADS FROM COPPER RIVETS

FIG. 2—CHISEL GROUND FOR CUTTING OFF HEADS FROM STEEL RIVETS

be found that the rivet heads can be flicked off with one blow of the hammer without chewing them up.

For steel rivets, grind the center of the chisel concave, as shown in Fig. 2, and the tendency for the chisel to work offside while hammering will be avoided. Chiseling is a comparatively tiresome task but this is avoided to a great extent by choosing the proper chisel and grinding it to suit the work. A soft or dull chisel should not be tolerated in any shop.

Formula for Tap Drill Size—Discussion

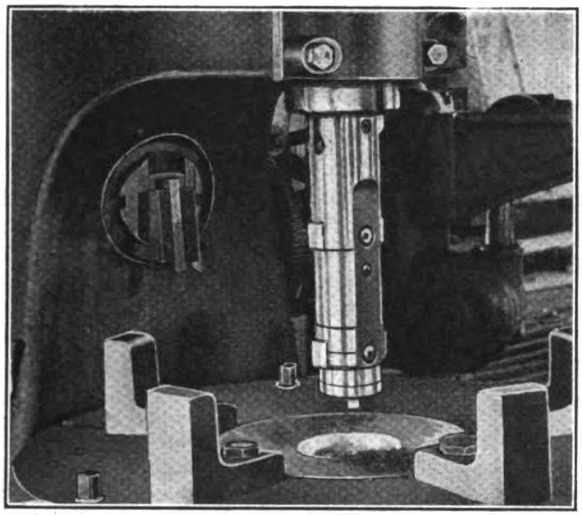
By Robert H. Barnes

In the article, "Formula for Tap Drill Size," which appeared on page 621 of *American Machinist*, William S. Rowell states that he has never seen in print the formula $\frac{1.3}{P}$ for determining the whole depth of a U.S.F. thread. I should like to refer Mr. Rowell to page 41, paragraph 27, Part 2 of Palmer's Practical Mathematics, for a discussion of this formula, and incidentally of two others in general use, that of $\frac{1.732}{P}$ for the double depth of a common V thread, and of $\frac{1.28}{P}$ for the Whitworth thread. These formulas have been used by the students in the Rochester Shop School for several years and have proved satisfactory on work where absolute accuracy was not required.

Tool for Boring Car Wheels

By C. Sackett

In placing new car wheels on axles from which condemned wheels have been removed, the wheels must be bored to fit the wheel seats, allowing for a forcing fit. As the wheel seats on different axles vary somewhat in diameter, the finish boring tool must be set for each wheel bored. The tool shown in the car-wheel boring machine is of the Davis expansion type and the ease of setting the cutters greatly facilitates the work.



MULTIPLE TOOL FOR BORING CAR WHEELS

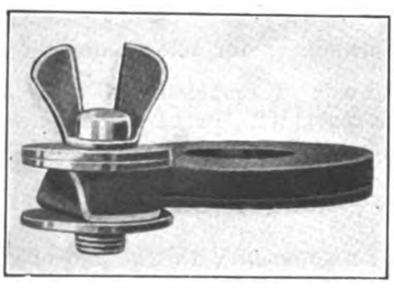
Two sets of cutters and one single cutter are carried in the bar. The lower set does the roughing, the set in the center takes the finishing cut, while the single cutter at the top chamfers the hole. The boring and chamfering are thus completed at one pass of the bar through the wheel hub and the time, floor to floor, is 8½ minutes. The tool as shown is in use at the Savannah shops of the Central of Georgia Railway.

An Improvised Clamp

By Harry Moore

The illustration shows a "heel" clamp that was made by one of our road men from odds and ends found in the bottom of his kit. It is not to be recommended as a substitute for the regularly manufactured article, but it shows what one may do in an emergency when and where proper tools are not available.

A machine screw, a wing nut and four washers comprised all the material that was required. The edge of one of the washers was bent up at a right angle the amount so turned up being, of course, equal to the thickness of the work to be held. The time necessary to dig the component parts out of the bag and to catch one of the washers in a vise and to give it a couple of swats with a hammer covered its making—less than is required to describe it.



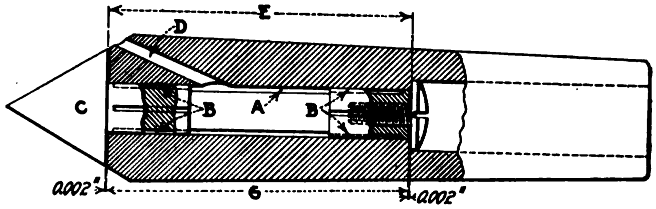
AN EMERGENCY "HEEL" CLAMP

An Antifriction Tailstock Center

By Herbert A. Althens

The accompanying sketch illustrates an antifriction tailstock center designed and used by the writer. At *A* is an oil well and at *B* are four grooves to carry oil from the well to all parts of the revolving member *C*. The oil well can be filled through the hole *D*.

The distance *E*, on the revolving member, is about 0.002 in. greater than that at *G* on the stationary member, so when the parts are assembled there will be enough play to prevent sticking. With a center of this type, there is no danger of burning the center holes in either the work or the mandrel.



ANTIFRICTION TAILSTOCK CENTER

Checking Inverted Spline Broaches

By H. R. Sleeper

It is sometimes desirable when milling or grinding inverted spline broaches or multiple spline shafts to check the indexing. The following formula, which the writer has used for several years in broach design, may be of interest to other tool designers and tool makers. Referring to the accompanying illustration:

$A = \frac{1}{2}$ the width of spline;

$B =$ Radius of broach, or shaft to be milled;

$\alpha = \dfrac{\frac{360^\circ}{N}}{2}$, when

$N =$ number of splines to be milled.

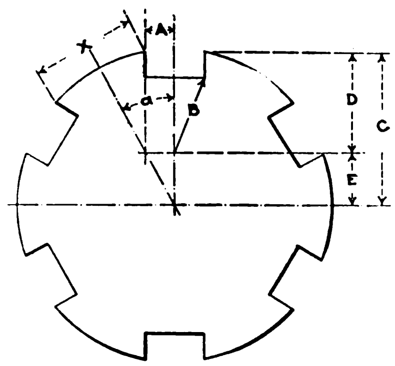


DIAGRAM OF SIX SPLINE BROACH

With these values known it is necessary to find chord *X*, the desired dimension:

$$\text{Now, } C = \sqrt{B^2 - A^2}$$
$$E = A \cot \alpha$$
$$D = C - E$$
$$X = 2D \sin \alpha.$$

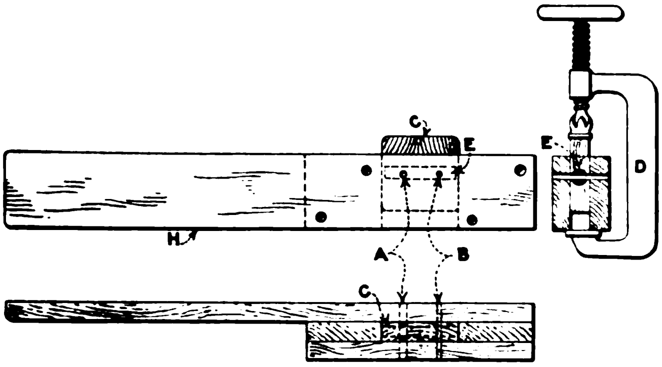
An Improvised Wire Straightener

By William S. Rowell

Having a number of pieces of music wire 24 in. long to straighten, the device shown herewith was made. Five pieces of wood, a piece of $\frac{3}{16}$-in. brass wire, four wood screws and a C-clamp comprise all the parts and one-half hour's time sufficed for the assembling. In operation, one end of the wire to be straightened is held in the chuck on a lathe and the other end passed through one of the holes *A* or *B* according to size.

With the straightener close up to the chuck and the lathe running at a moderate speed, pressure enough to bend the wire slightly is put on the slide *C* by the Clamp *D*.

The straightener is then moved along the wire fast enough to prevent permanent waves being left in the wire, part *H* resting against the lathe bed to keep the straightener from turning. The $\frac{1}{16}$-in. brass wire is



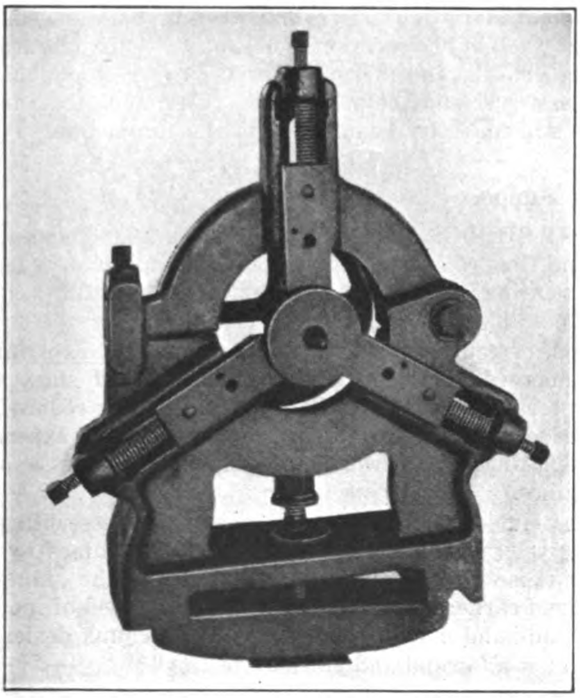
AN IMPROVISED WIRE STRAIGHTENER

inserted in the slide, as shown at *E*, and the holes *A* and *B* are drilled through it to make a better wearing surface than would be afforded by the wood. The results obtained by the use of this device were so good that it was afterwards used to straighten nickel-steel wire much larger in diameter than the music wire referred to.

Increasing the Distance Between Lathe Centers

By Joran Kyn

When work is a little too long to go between the centers of a lathe, the tailstock can be taken off and a bushing carrying a center placed in the jaws of the steadyrest, as shown in the illustration herewith. The center is formed on the end of a screw fitted to a



A SHORT TAILSTOCK

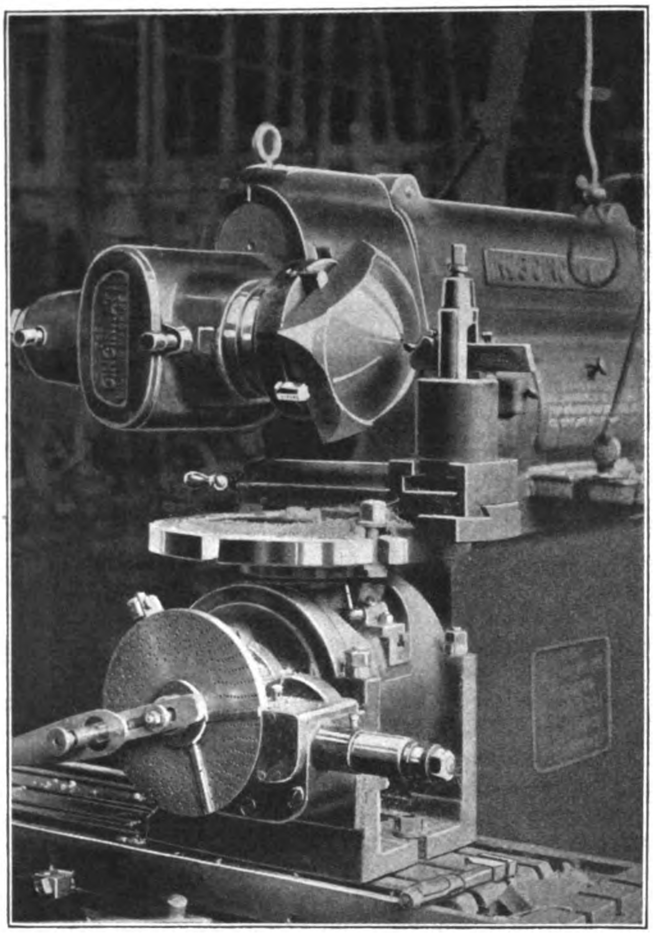
tapped hole in the bushing and can be adjusted to suit the work by the hand wheel attached at the rear.

As the steadyrest occupies much less room on the lathe bed than the tailstock, the use of this device allows work several inches longer to be accommodated between the centers. While it has a much shorter bearing on the lathe bed and is not as rigid as the regular tailstock, because the thrust of the cutting tool is usually toward the headstock, it answers very well for ordinary work but would, of course, hardly be satisfactory for heavy cuts. In common with many other improvised devices, it must be used with judgment in order to be satisfactory. This device is in use in the Savannah shops of the Central of Georgia Railway.

Turning a Spherical Surface with the Milling Machine

By A. Nelson

Being in need of a clamping block with a spherical surface and not having a radius turning attachment of any kind for any of our lathes, we rigged up the simple outfit shown in the illustration to do the work.



SPHERICAL TURNING IN THE MILLING MACHINE

By taking the compound slide off an old lathe that had a high toolpost we obtained the necessary height for clearance between the dividing head and the work, and also provided a very close adjustment for the radius by means of the slide.

By altering the position of the tool so that it would stand on the other side of the center of rotation a concave surface could as readily have been produced.

Editorial

TREATING of prospective customers used to be a great game in the machine tool industry, especially for the customers. The only kind of treating you'll find nowadays is heat treating, and it certainly does the recipient a whole lot more good than the pre-Volstead variety. The world is growing better.

The American Machinist Is Forty-five Years Old

FORTY-FIVE YEARS ago this month the first issue of the *American Machinist* left the press to carry its message to the young and feeble machinery industry. It was very different in appearance from the present magazine. The page was larger, the type smaller, the contents very much less. But it was animated by the same spirit of service that has guided its various editors and publishers ever since and which immediately obtained a hold on the affections of its readers that has never been shaken.

Some of these older readers, and many of the younger ones, have taken the trouble to write in to us and tell us what they liked about the paper and what they didn't like. Without this hearty and valuable co-operation it would be an impossible task to keep on improving our pages. We want to take this opportunity to renew our thanks to those good friends.

Times have changed since our last birthday editorial was written. The industry had only then past the bottom of the business depression and profitable operation was a thing of the future. General business has caught its stride since then and most of the usual lag period between general prosperity and activity in the machine industries has become history. Even the machine tool builders, the last link in the manufacturing chain, have reached a point where the scarcity of good machinists is becoming a problem.

From the technical standpoint two events in the past year stand out as of vital importance to machinery builders and users. The first is the appointment of the joint standardization committee of the American Society of Mechanical Engineers and the National Machine Tool Builders Association to take up the standardization of such items as tool holders and tool posts, T-slots, spindle noses and tapers.

The other is the rather modest beginning of a research program which cannot but have its effect on an art that has made so little use of science as has that of metal cutting. Except for the introduction of several new cutting alloys and the increase in the size, power and capacity of our machines there has been little progress in the last generation in the actual removal of metal. Perhaps we have reached the ultimate in the art of cutting metals but in view of the achievements of the last decade in such fields as radio telephony and aeronautics it hardly seems likely.

A prophet is not without honor save in his own country. Yet we have the temerity to predict that, if a real research program be carried out, by the time the *American Machinist* reaches the half century mark, its pages will have told of developments beyond the wildest dreams of its first readers and even far exceeding the expectations of many of its younger ones.

We have referred to standardization and research as technical functions but as a matter of fact their economic bearing is at least equally significant. One has but to note their economic effect on such an industry as the automobile industry, where they have been employed in a small way, to see the possibilities in other fields.

Cylinder Lapping and Motor Balancing—Two Problems in Automobile Practice

THERE IS A FEELING among some production men that lapping may come back as a final finishing operation for cylinders. Whether it will eliminate cylinder grinding, or only supplement it, is a disputed point among its advocates. Where it replaces grinding, the use of the abrasive brick or stone, held in a suitable head, seems to be very successful, although some use a cast iron lap and an abrasive powder. When used as a final finish after grinding, only a very little lapping is done and a very fine abrasive is used.

The attempt to secure better running motors has led to much greater care being taken in balancing crankshafts and in selecting pistons, pins and rods of equal weights. Not only is the weight of the whole rod considered, but the weight of the big end, which affects the revolving weights, is also measured separately and rods are sorted into sets with this in mind. But even with all that precaution motors do not always run smoothly. There are certain speeds at which vibration occurs, even in some of the best built cars.

It sometimes happens that motors run well on the test stand but develop vibration at certain speeds when mounted in the chassis. There seem to be speeds at which the motor vibration synchronizes with vibrations of the chassis, and the combination is very objectionable to the driver and the passengers. This and other problems still confront the designer of the automobile.

Just Suppose

JUST SUPPOSE that you are a machine tool salesman and that you approach the works manager of a large plant with a new machine tool having wonderful production possibilities.

You, of course, put up a good selling talk explaining the many advantages of this machine, and show the prospective customer wherein he can greatly reduce his manufacturing costs and cut down overhead expenses by replacing his old, worn-out equipment with these new machines.

Just suppose that the works manager agrees with you and gives you a sizable order for new machines to replace those which have long since passed the stage of dividend earners, and which are to be disposed of, not to a second-hand machinery dealer, but to a junk dealer.

Isn't it a "grand and glorious feeling"?

Of course, this could never happen, but—

Just suppose.

Shop Equipment News

Cincinnati 12-Inch Plain Cylindrical Grinding Machine

The 12-in. plain cylindrical grinding machine now made by the Cincinnati Grinder Co., Oakley, Cincinnati, Ohio, resembles the former model, which was described on page 42, Vol. 38 of *American Machinist*, in general appearance only, as the working mechanism has been almost entirely redesigned. Front and rear views of the present model are shown in Figs. 1 and 2.

The machine is intended for grinding straight or tapered spindles, shafts, rolls, tubing and work of like character within its range which can be revolved on centers. It is made in 12-in. swing and 18, 24, 36, 48 and 72-in. work lengths, with either belt or motor drive. The 24-in. length machine weighs about 6,000 lb. and occupies a floor space of 67½ by 114 inches.

The spindle is driven directly from the countershaft by a long, wide belt and no jackshaft nor short belt are employed, as formerly. The bearings are constructed to carry the belt pull without influencing the accuracy of operation of the spindle and wheel.

As can be seen, the control is centralized on the front of the machine within easy reach of the operator when in his normal operating position. The machine is built on the unit system, each unit complete in itself, being assembled in its entirety on the bench and then placed

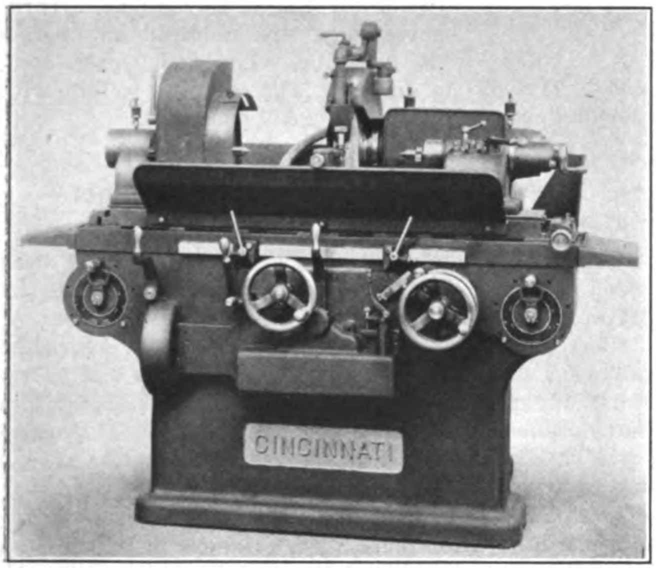


FIG. 1—CINCINNATI 12-INCH PLAIN CYLINDRICAL GRINDING MACHINE

in position on the main structure. This construction permits of easy removal of any unit for adjustment or repairs without disturbing the alignment of any other unit. Each unit is provided with a central oiling station. The base, wheel slide, pedestal and water tank are cast integral with each other, forming a massive understructure for the entire assembly.

The work is revolved by means of a belt-driven headstock embodying in its construction a spring idler to give the proper belt tension. Six work speeds are provided for the spindle and six for the table, all of which speeds are obtained through a single gear box, Fig. 3, mounted on the rear of the machine. The gears in this speed change box are made from hardened bar stock

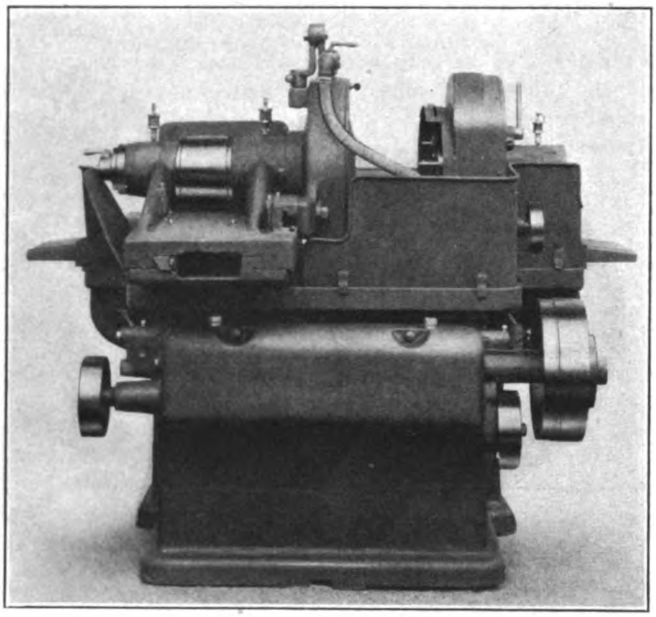


FIG. 2—REAR VIEW OF CINCINNATI CYLINDRICAL GRINDING MACHINE

and slide on solid splined shafts. The employment of the gear drive eliminates belt slippage and furnishes a very convenient and rapidly operated means of changing speeds.

The automatic reverse plate on the front of the machine is of the load and fire type, so made that the gears at all times run in a bath of oil. The plate carries the table control lever, which also controls the table traverse handwheel. When the lower traverse to the table is engaged by means of the traverse lever, the handwheel is automatically disengaged and remains stationary during the travel of the table. When the power traverse is disengaged, the handwheel is automatically engaged so that the table may be traversed by hand. The table clutch lever also controls a variable tarry device or table dwell at the end of the table stroke, which is used when grinding shoulder work. The cross feed may be either hand or automatic, and the range is sufficient for quickly reducing stock or for producing an extremely high finish, to suit the nature of the work.

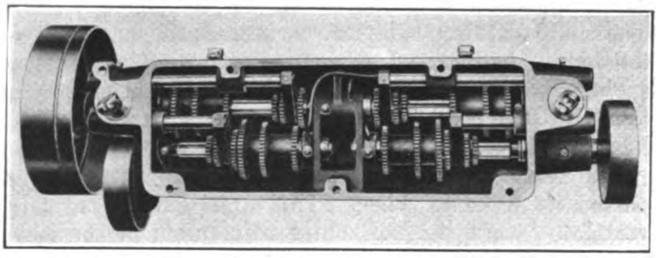
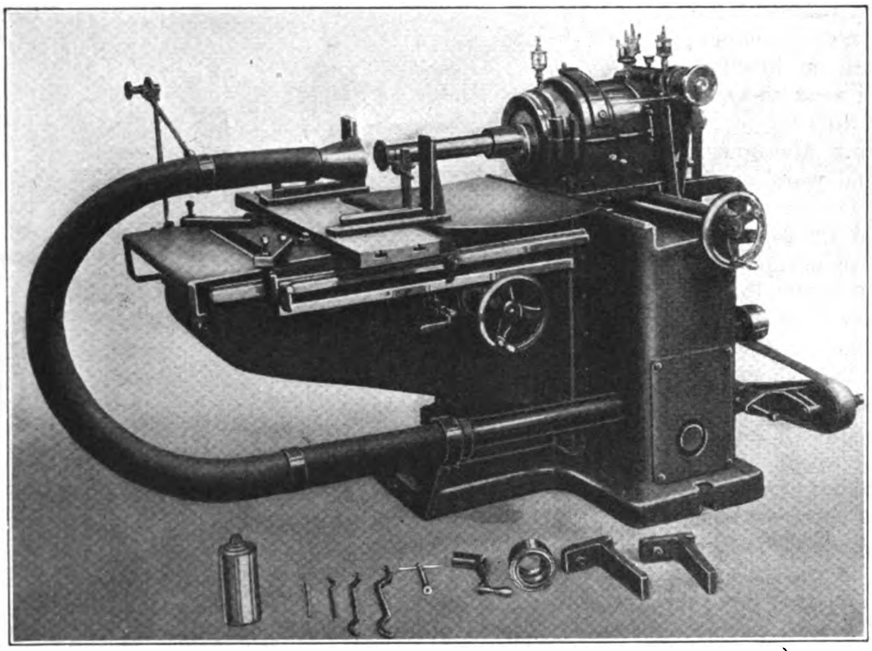


FIG. 3—INSIDE OF SPEED-CHANGING GEAR-BOX UNIT

Madison Cylinder Grinding Machine

Manufacture of the Madison cylinder grinding machine has been taken over by the Gisholt Machine Co., Madison, Wis. The machine, a general view of which is shown in the accompanying illustration, is adaptable to practically all kinds of automotive cylinders with the use of the standard equipment only. It can be employed on either open-head or closed-head cylinder blocks.

The wheel spindle is of the two-piece type, made of special alloy steel, heat-treated and ground, and carried in a double eccentric sleeve. It is full-floating and is,



MADISON CYLINDER GRINDING MACHINE

therefore, free from strain from the driving belt. No unnecessary overhang of the wheel need be employed. For average work the outer spindle can be short and rigid; a longer spindle may be employed where it is required. The spindle runs in an adjustable bronze bearing and a self-aligning ball bearing which takes up the end thrust also.

Large bronze bearings in the headstock support the eccentric sleeve, which in turn carries the spindle. The rotary motion of the eccentric sleeve is obtained through a wormwheel drive that gives smoothness of motion. For convenience in starting and stopping, the drive is controlled through a powerful friction clutch driven by an endless belt. The eccentric adjustment of the spindle, which can be accomplished while the head is in motion, is made by means of a worm and ratchet gear device. A micrometer dial is provided so that the final adjustment to size can be accurately and easily obtained.

So that wheels can be changed without being trued up each time that they are placed in the spindle, the grinding wheel is mounted on an independent collet. The main driving belts are so arranged that an even tension is maintained without the use of weights or springs, regardless of the position of the headstock on the bed. The headstock is mounted on a carriage which has a transverse motion directly on the ways of the bed.

The work is held on a table which, in turn, is supported by a heavy knee. This knee can be adjusted vertically, while the horizontal adjustment of the wheel to the work is obtained by the movement of the carriage. The table carrying the work can be moved parallel to the wheel spindle to feed the cylinders to the wheel. Adjustable stops are provided to automatically trip and reverse the feed. The large vertical adjustment of the knee enables grinding cylinder blocks of a large range of sizes and types. The work is held between the ways or directly over them so that it does not overhang.

A heavily ribbed cabinet-type bed is employed. Aprons mounted on rollers protect the ways from dust. Each oil hole is also protected from dust. An exhaust fan is mounted in the base of the machine, so that it is out of the way and well protected. A rubber hose of large diameter carries the dust away from the wheel.

The cylinder block is ordinarily clamped to a pair of parallel supports, one at each end of the block. Two small jacks placed in the center of the overhanging portion of the cylinder hold the block steady. To centralize the wheel to the bore, the handwheel on the knee is used to raise or lower the work, and the handwheel on the bed to move the wheel horizontally.

The capacity of the machine may be judged by the dimensions that follow. The vertical distance from the top of the platen to the center of the spindle can be varied from $2\frac{1}{4}$ to 9 in. The extreme cross travel of the headstock is 27 in., and the longitudinal travel of the table 22 in. Feeds of 4.8 and 9.2 in. per minute are provided for the table, and speeds of 5,000 and 7,000 r.p.m. for the wheel spindle. Three horsepower are required to operate the machine. The floor space occupied is 71 x $57\frac{3}{4}$ in. in size. The shipping weight with the countershaft included is 2,600 pounds.

Stevens "Speed Up" Garage Tools

Several time-saving devices for use about the garage for repairing automotive engines have recently been added to the line of "Speed Up" tools marketed by Stevens & Co., 375 Broadway, New York, N. Y. At the left of Fig. 1 is shown a reseating tool by which the valves on all 45-deg. removable-head motors can be reseated regardless of their size. It is not necessary to change pilots or cutters for different sizes of valve ports, and there are no separate parts to become detached and lost.

The pilot is made in one piece and stepped off for four sizes of valve stems, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$ and $\frac{1}{2}$ in. Each step is slightly tapered, so as to obtain a snug fit in the valve guide. The pilot telescopes into the handle and is forced outward by means of a coil spring, so that it quickly seats itself in the valve guide. The inside edge of the tool-steel cutter is $1\frac{1}{8}$ and the outer edge 3 in. in diameter.

A sleeve for fitting rings to pistons without injury to the pistons, the rings or the fingers of the operator is illustrated on the right side of Fig. 1. The sleeve can also be used when slipping assembled pistons into the cylinder block. It serves to keep the rings compressed and the ring joints properly spaced. This application is also illustrated. The sleeve is split, and is

made of tempered steel in five sizes to fit diameters from 2⅝ to 5⅛ inches.

A vise for holding pistons is shown at the top of Fig. 2. Work such as speedometer heads, clocks, ball bearings and universal-joint parts also can be held in the vise, without danger of injury as might occur if an ordinary machinist's vise were employed. Four points of contact on the work are provided, the jaws

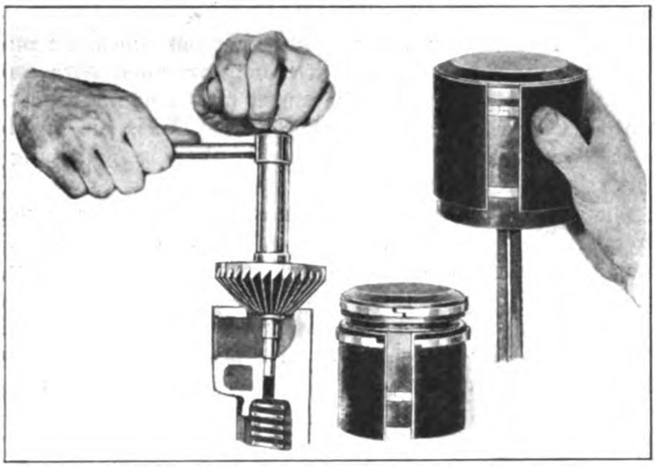


FIG. 1—STEVENS "SPEED UP" VALVE RESEATER AND PISTON SLEEVES

being lined with lead. One jaw is fastened to the base, on which the piston rests directly, and the other jaw is movable by means of a screw and handwheel. The base of the device is 10½x5½ in. in size, and work up to 5½ in. in diameter can be held. The weight is 13 pounds.

In the illustration a piston is clamped in the vise and the grooves are being cleaned by a special cleaner made for that purpose. The cleaner consists primarily of a metal band, on the inside of which are four V-shaped points that fit into the piston groove. The

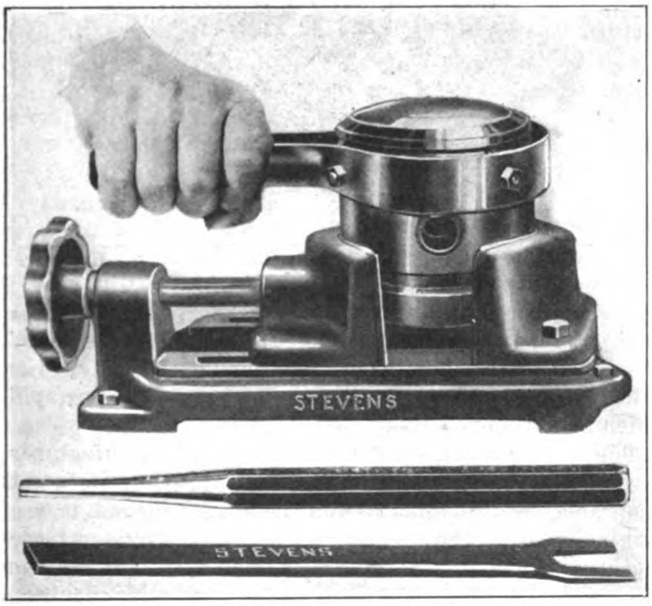


FIG. 2—STEVENS "SPEED UP" PISTON VISE, GROOVE CLEANER, PUNCH AND PRONGS

cleaner is turned around the piston and at the same time raised up and down, so that both the bottom and the side walls of the groove are cleaned of carbon. This operation can be very quickly performed. The tool is made in two sizes, one for pistons 3¾ in. in diameter and over, and the other for smaller ones.

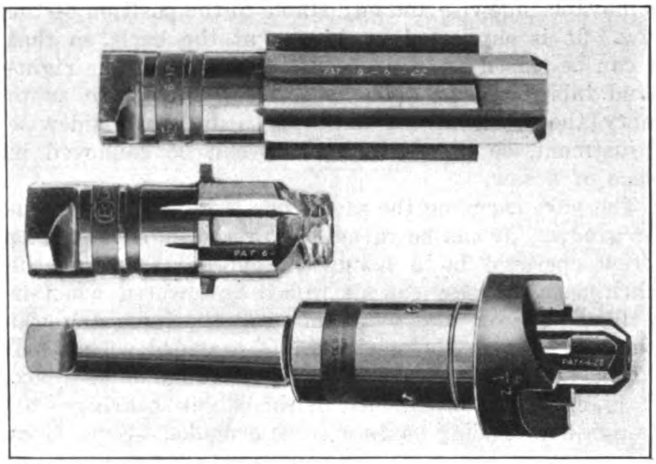
A set of Giant punches 12 in. in length for general use when lining up holes in assembling, and when driving pins and bolts that are difficult of access, also has recently been added to the line. The points of the punches are formed straight for a length of 1½ in., so that they can follow into a hole without hindrance. The punch can be seen in the center of Fig. 2.

The punches are made of tempered chisel steel in three sizes, having point diameters of ⅜, 5/16 and ¼ in., respectively. Octagon stock ¾ in. across the flats, is used for the two larger sizes and ⅝ in. for the smallest. The punches can be furnishes singly or in a set packed in a wooden box.

The tool shown at the bottom of Fig. 2 is a utility prong for general use when repairing parts. It is particularly applicable to such work as compressing springs and prying parts when assembling or disassembling mechanisms. Its overall length is 16 inches.

Eclipse Interchangeable Multi-Diameter Tool

The Eclipse Interchangeable Counterbore Co., Detroit, Mich., has recently placed on the market multi-diameter counterbore cutting tools having separate blades to cut each diameter. The tools are intended for use with the regular interchangeable counterbore made by the concern, to replace the tools having all the diameters on one set of flutes. They are for use on automotive engines especially for machining core holes to receive Welsh plugs, and for machining spark-plug holes. The principle may be employed when machining any number of diameters, and the tool has been made for finishing as many as six diameters by means of one cutter.



ECLIPSE INTERCHANGEABLE MULTI-DIAMETER TOOL

The construction of the cutting tool can be seen in the view at the top of the accompanying illustration. This tool is for cutting two diameters, and is equipped with two sets of blades. The small diameter blades extend the full length of the tool and are placed between the blades that cut the large diameter. Since only blades of equal length bore any given diameter, greater rigidity is claimed.

The principal feature of the tool is its long life. It is possible to grind both diameters all the way from the forward end to the rear, so that the tool appears as shown in the center of the illustration when it has been

used to its limit. The life is equal to that of the full length of the blades that cut the largest diameter. Its life is thus much greater than that of the counterbore in which both diameters are on the same blades, as such a tool must be discarded when the length of the small diameter blade has been ground away. It is not possible to grind further without decreasing the diameter of the small end.

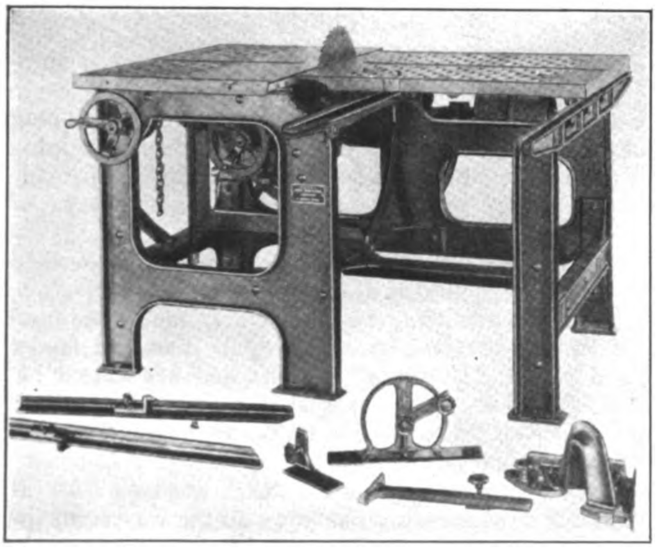
The cutters are interchangeable with the regular cutters employed in the counterbore made by the concern. At the bottom of the illustration can be seen a view of the tool assembled for cutting three diameters, the adaptability of the system being well illustrated.

Hooker Universal Saw Bench

A fully universal bevel and miter saw bench equipped with a tilting arbor and sliding table is shown in the accompanying illustration. The machine, which is designated as the No. 1, has recently been brought out by the Hooker Manufacturing Corporation, St. Johnsbury, Vt. It can be quickly changed for performing different classes of work. The saw can be raised or lowered perpendicularly by turning a handwheel, a feature that adapts it for grooving or rabbeting. By turning the handwheel on the front of the machine, the saw can be tilted from the perpendicular to any angle up to 45 degrees.

The frame is rigidly constructed, but allows easy access to all parts of the machine. The left-hand table is movable sidewise and adjustable to the position of the saw. It is supported by hinges at the back, so that it can be raised and tipped out of the way. The right-hand table runs on rolls fitted to the track, so as to carry the work to the saw. It also has a sidewise adjustment, so that a dado head can be employed in place of a saw.

The yoke carrying the saw arbor is guided in a circular groove. It can be raised or lowered by an elevating screw operated by a handwheel on the front of the machine. The saw can be raised or lowered when in a tilted position, and still remain at the same angle at which it is set. The saw arbor is provided with a ball thrust bearing between the saw collar and the box. It is ordinarily furnished with babbit bearings, although ball bearing boxes may be provided. Saws from 6 to 18 in. in diameter can be used, the latter size allowing stock up to 6½ in. thick to be cut, a capacity large enough for general work.



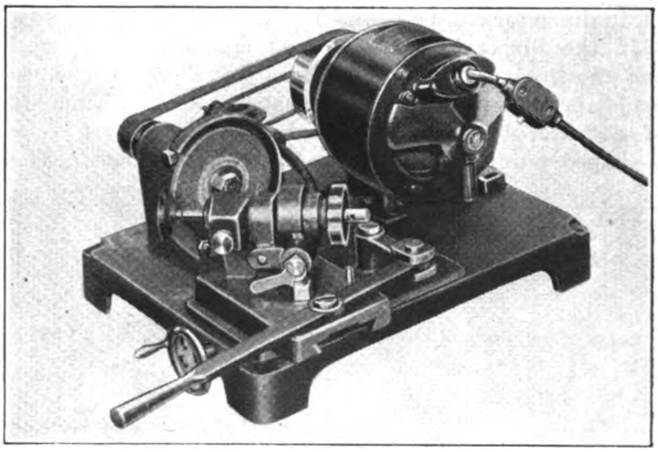
HOOKER UNIVERSAL SAW BENCH NO. 1

Tight and loose pulleys, the latter pulley being equipped with phosphor-bronze bushings, can be provided on the countershaft when belt drive is desired. For motor drive, a 3-hp. motor is supported by brackets on the rear of the frame and connected directly to the countershaft by means of a flexible coupling. Since the motor is not built in, any standard design can be employed. The saw arbor is driven from the drum on the countershaft by means of a belt provided with an idler for tightening it. The speed of the countershaft is ordinarily 1,200 r.p.m., while 3,600 r.p.m. is the speed of the saw arbor that is obtained with the size of driving pulleys usually employed.

The machine is furnished with an adjustable rip gage, an adjustable miter gage, two adjustable stop gages, and two cut-off gages. It requires a floor space of 72 x 58 in. The net weight of the belt-driven machine is 1,100 lb., and that of the motor-driven machine 1,350 lb. The gross weights are 1,250 and 1,550 lb., and the size of the export packing cases 125 and 150 cubic feet.

Franklin Portable Valve Grinding Machine

A portable machine for grinding automotive poppet valves to a fixed angularity, and for grinding reseating cutters adapted for cutting valve seats to the same angularity as that of the valve, has recently been developed by the Franklin Machine & Tool Co., Spring-



FRANKLIN MODEL C VALVE GRINDING MACHINE

field, Mass. The machine is designated as the Model C and is shown in the accompanying illustration. It is intended especially for repair shop work to enable rapid finishing of valves.

The machine can be assembled by the manufacturer for grinding valves to any desired angle, but it is not adaptable for adjustment from the angle to which it was originally set at the factory. It is thus a single-purpose machine. The motor, which is manufactured by the Westinghouse Electric & Manufacturing Co., is mounted on a low, flat base. It is located far from the grinding wheel, the cross slide, and the valve rotating members so as to prevent motor vibration from affecting the accuracy of the grinding operation. A hand lever serves for reciprocating the slide carrying the work, so as to move the valve across the face of the wheel. A handwheel provides the feed toward the wheel.

Oakley No. 1 Cutter Grinder

The No. 1 cutter grinder shown in Fig. 1 has recently been placed on the market by the Oakley Machine Tool Co., Middletown, Ohio. It is especially fitted for work in small plants having only one or two milling machines and a small toolroom. It will handle all of the work encountered there, but is not as expensive as a machine having a large range and a great number of attachments. The machine is similar in characteristics to the Nos. 2 and 3 Oakley cutter grinders, the latter of which was described on page 786, Vol. 53 of *American Machinist*.

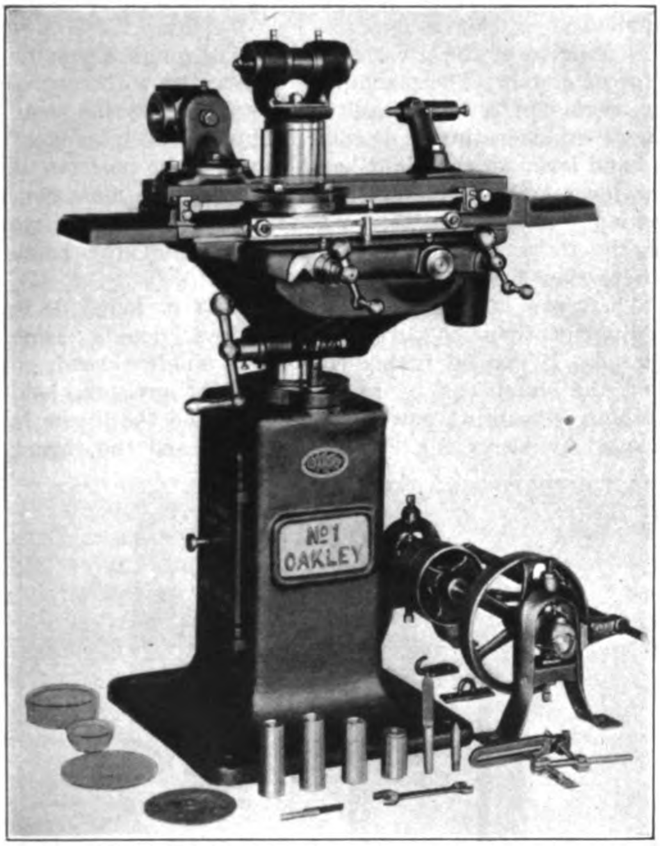


FIG. 1—OAKLEY NO. 1 CUTTER GRINDER

The bearings of the saddle and slide are made with one flat and one V surface. They are very liberally proportioned, so as to add to their life, and their construction is such that the slide can be easily removed for cleaning. The table is supported in the middle and at both ends, with provision for taper adjustment in inches or degrees. A large knee with a long bearing on the column supports the saddle. The lightest portion of the machine is swivelled instead of the heavy working parts. Thus, the table position can be maintained and the wheel head swivelled on the column through 180 deg. in either direction. The wheel spindle runs in ball bearings, is driven by belt from an overhead countershaft and carries two wheels in the usual manner.

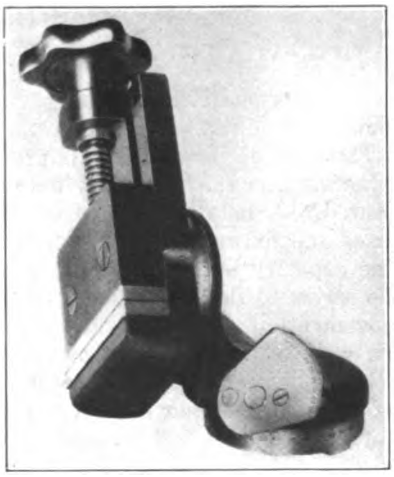


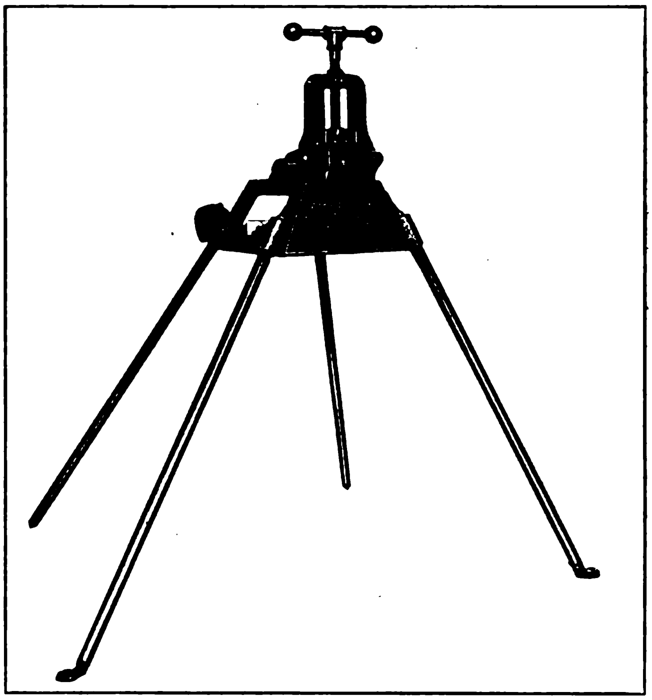
FIG. 2—OAKLEY UNIVERSAL VISE

A fast or slow table movement can be obtained by means of a slip gear that can be reached from the operating position. The operating levers are so arranged that the machine can be manipulated from either side. The longitudinal movement provided is 12 in. in length, the cross movement 5¾ in., and the vertical movement 9 in. The machine takes 15 in. between centers, provides a swing over the table of 8 in., and can sharpen face mills up to 10 in. in diameter. The maximum distance from the table to the spindle is 8¾ inches.

Various attachments are furnished with the machine to adapt it to the jobs encountered in the average toolroom. Attachments to suit special requirements can be fitted. In Fig. 2 is shown a vise having a wide adaptability that is furnished for the machine. The vise is completely universal and can be swivelled through any angle required. When performing surface grinding on work that must be held flat and very rigid, the vise proper can be detached from the swivel and used directly on the table of the machine.

American Pipe Tool Co. Portable Pipe-Vise Stand

A portable stand for the use of plumbers, steamfitters, electricians and pipe-fitters for supporting a pipe vise has recently been placed on the market by the American Pipe Tool Co., 123 South Jefferson St., Chicago, Ill. The stand is shown in the accompanying illustration fitted with a pipe vise. It is made of malleable iron, and provided with a shelf for holding tools. The pipe bender is a part of the body casting, and the legs are easily attachable and detachable. The legs are provided with holding points and feet to prevent slipping.

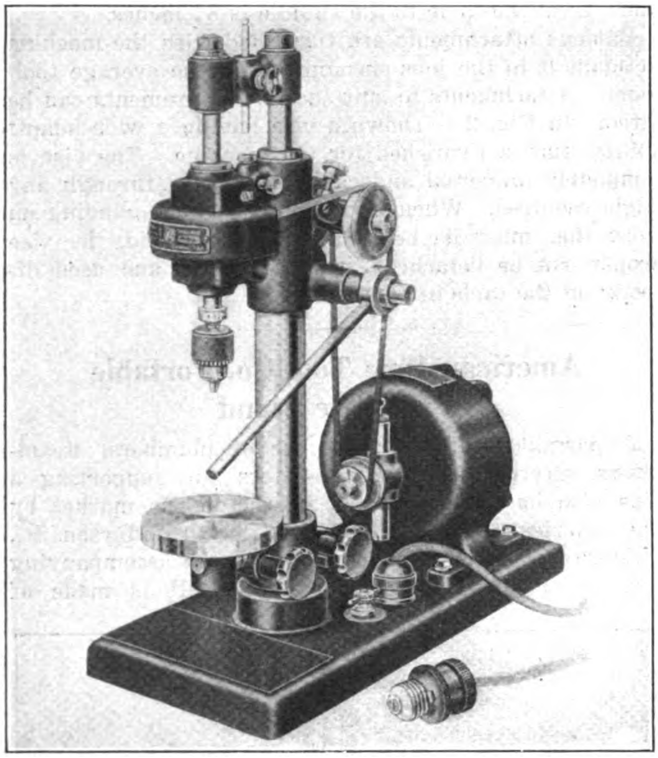

"AMERICAN" PORTABLE PIPE-VISE STAND

The stand can be drilled for holding any type of hinged or chain pipe vise having a capacity up to 2½ in. Its weight complete with the vise is about 50 pounds.

Muehlmatt Sensitive Drilling Machine

Adolph Muehlmatt, Lion Bldg., 5th and Elm Sts., Cincinnati, Ohio, has just placed on the market a sensitive drilling machine suitable for precision tool and manufacturing work within its capacity. Owing to the fact that there is nothing at the front of the machine to catch hair, the machine is well adapted for use in plants employing female operators.

As may be seen in the illustration, the machine and motor are entirely separate, making it possible to substitute another motor at any time, or to drive the machine from overhead. The base rests on three rubber contacts, which with the 55 lb. weight of the machine, make it stay firmly in position on the bench, without the necessity of using bolts or clamps. The spindle is $\frac{5}{16}$ in. in diameter, is hardened and ground and has a vertical travel of 2 in. controlled by adjustable stops. The idler pulley bracket is adjustable by means of a thumbscrew, giving any desired tension to the drive belt, which goes directly to the spindle.



MUEHLMATT SENSITIVE DRILLING MACHINE

The column is of steel, $1\frac{1}{2}$ in. in diameter and 13 in. high. The table is adjustable radially as well as vertically. There is a 4-in. space between the table and chuck, and 8 in. between the base and chuck. The chuck takes any size of drill up to $\frac{1}{4}$ in. The feed is of the ratchet-lever type, so that the operator may readily get the position desired for the hole. The construction of the table bracket makes it easy to remove the table and fit jigs of various kinds in its place, if desired.

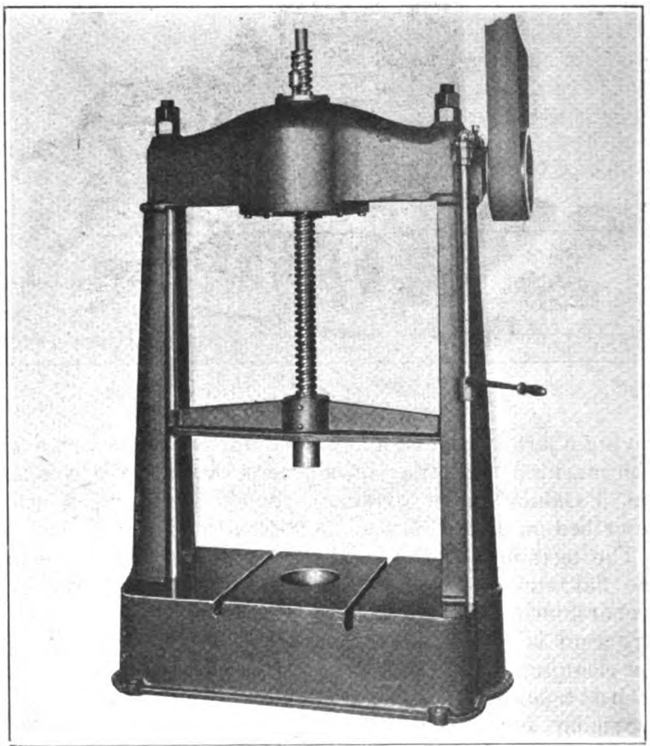
The spindle speed is from 1,500 to 2,500 r.p.m., but any speed up to 8,000 r.p.m. may be had on order. The front pulley guard is easily removable in order to shift the belt when changing speeds. The motor switch is made especially for this machine. The excess of used oil is thrown off into chambered recesses and then runs down by gravity. With this construction and ordinary caution in oiling, the machine will not sling oil even when running at its highest speed.

Atlas Power Screw Press No. 63

A power-operated screw press that has recently been placed on the market by the Atlas Press Co., Kalamazoo, Mich., is shown in the accompanying illustration. The press, which is designated as No. 63, is intended for pressures up to 50 tons. For work from 25 to 30 tons, the ram speed is about 7 ft. per minute, although the speed varies with the amount of pressure applied.

The drive of the press is operated through a marine type of clutch. The machine is illustrated with control by means of a handwheel on the front of the head. However, operation is regularly obtained by means of a hand lever on the right-hand housing, the position of the lever being adjustable, so that it can be most conveniently placed for the operator. All working parts of the drive are mounted on the back of the head, where they are easily accessible.

The screw is 3 in. in diameter and 48 in. long. It is ordinarily furnished with a 2-in. lead, double Acme thread. It can be furnished with a single thread, so that the clutch can be released and the pressure held without consuming power. The thrust on the screw is carried by heavy S.K.F. ball bearings, and the thrust on the worm by radial and thrust ball bearings. The remainder of the bearings are S.K.F. ball bearings.



ATLAS POWER SCREW PRESS NO. 63

The base of the machine is provided with T-slots and a keyway, so that jigs and fixtures may be accurately located. A hole can be cored in the center. Special bases and fixtures can be supplied to suit special work. The capacity between the upright is $37\frac{1}{2}$ in., and from the screw to the base 32 in. The ram has a maximum movement of 24 in. A motor base can be secured to the rear of the machine base, when individual motor drive is desired. A 5-hp. motor running at 1,200 r.p.m. is ordinarily employed. An hydraulic pressure gage can be supplied. The machine requires a floor space of 27 x $48\frac{1}{2}$ in., and is 76 in. high overall. Its shipping weight is 2,900 pounds.

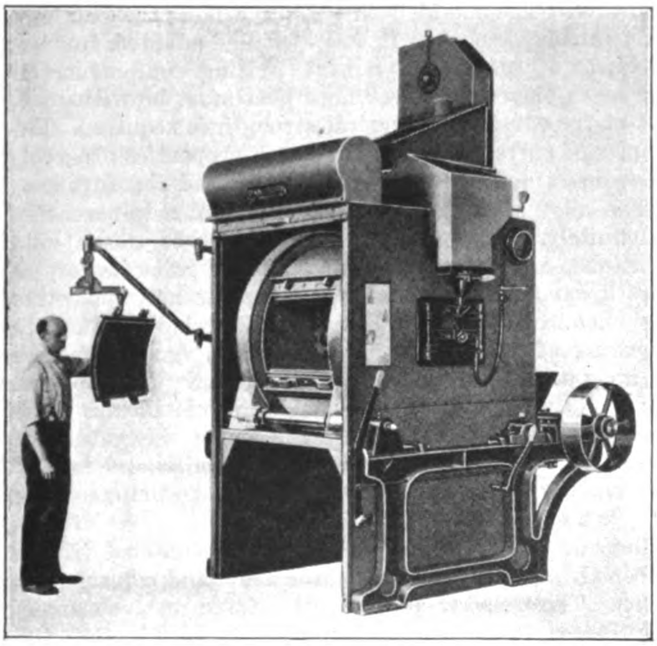
Pangborn Large Barrel-Type Sandblasting Machine

A barrel type of machine for cleaning work by means of a sandblast is shown in the accompanying illustration. The machine has recently been placed on the market by the Pangborn Corporation, Hagerstown, Md. It is similar in construction, although much larger than the barrel sandblasting machine described on page 778, Vol. 55 of *American Machinist*. It can be furnished with drums of two sizes, one 30x40 in., and the other 50x40 in., which makes the machine available for work from small size to that as large as is feasible for barrel cleaning.

The nozzles in the machine are made adjustable in both horizontal and vertical positions, so that the most effective location can be secured. This action is necessary because of the fact that the cleaning capacity of a sandblast is governed by the distance of the nozzle from the work and its angle to the work. The adjustment provided for the nozzles allows for accommodating different classes of work, as regards both the size of the pieces and the "ride" within the barrel due to the rotation.

A mechanical separator gives constant separation of the abrasive for reuse. It consists of a ribbed roller driving against a shaft protected by heavy rubber tubing, the latter taking all of the wear and being quickly and cheaply replaceable.

Every moving part is so made as to withstand continuous service, and to give long life to the press. The barrel itself is reinforced at the door opening, with plates and angles both inside and out. Steel tires pinned to the head castings and driving on manganese steel



PANGBORN BARREL SANDBLASTING MACHINE

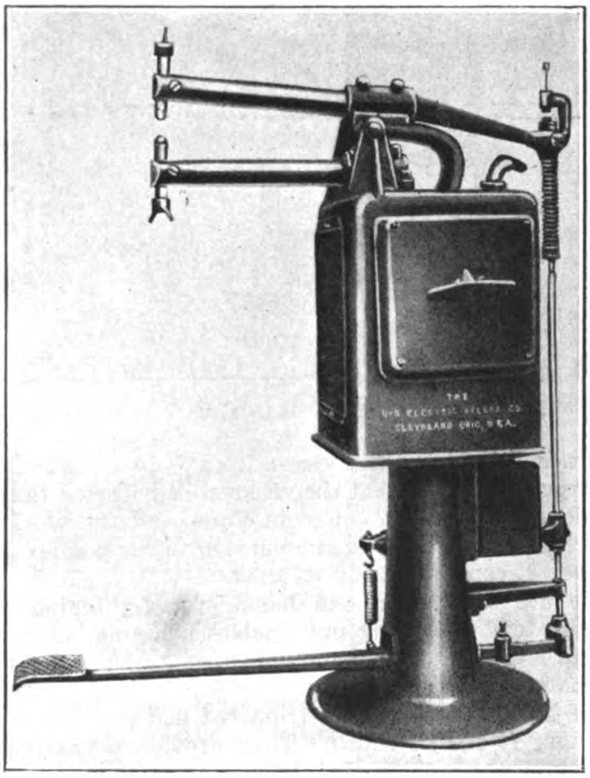
rollers, the front rollers being idle and equipped with roller bearings, provide even traction with but little wear. The driving sprockets are steel and the chain runs in a bath of oil, which is inclosed to exclude dust. The clutch is simple and positive in its action, so that the motion of the drum can be easily engaged and disengaged.

It is stated that in the design of the machine economy of operating cost has been given the greatest consideration, from the viewpoints of both the increased efficiency of the blasting acting and the durability of the equipment itself. Great economy is claimed when cleaning in bulk work adapted to this method.

"U. S." Electric Welding Machine

The U. S. Electric Welder Co., 327 Permanent Bldg., Cleveland, Ohio, has recently placed on the market the welding machine shown in the accompanying illustration for use on light and medium stock. The machine can weld rough oxidized as well as smooth stock. About 4 sec. per weld are required for $\frac{3}{16}$-in. material, while the production when welding two $\frac{1}{16}$-in. bright steel sheets is stated to be 4,000 welds per hour.

The machine is made in two sizes, having kva. capacities of 12.5 and 18, and horn sizes of 2 and $2\frac{1}{4}$ in.,



"U. S." ELECTRIC WELDING MACHINE

respectively. Various lengths of horn can be furnished. The machine is designated as the S.A.F. and as the S.A.M. when equipped with a motor. The former style in the 12.5-kva. size and equipped with a 12 in. length of horn is illustrated.

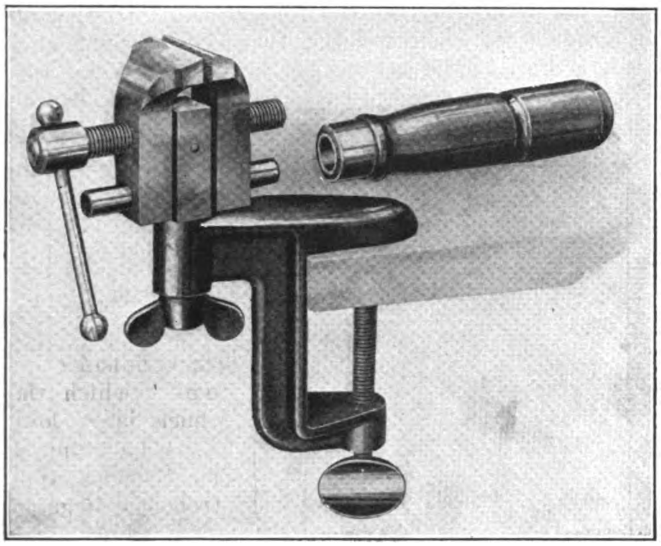
The machine is equipped with a "U. S." welding transformer of the type described on page 468 of *American Machinist*. The internal automatic reactance prevents breakdown and overload, and enables the machine to handle heavy stock without overheating. The automatic switch is equipped with a magnetic blowout and removable contacts, and it is entirely inclosed. A 5-point pivot switch provides for different voltages at the welding point. All conductors carrying the line voltage are inclosed.

The welding points are water-cooled. Pressure is placed on them by means of the treadle at the front of the machine acting through a system of links. Heavy pressure on the point can be obtained when desired, because the moving parts are all strongly made.

Starrett Combination Hand and Bench Vise

A general utility vise suitable for use both in the hand and attached to a bench, has recently been placed on the market by the L. S. Starrett Co., Athol, Mass. The vise, which is designated as No. 86, is shown in the accompanying illustration as arranged when clamped to a bench, although the detachable handle can be seen.

A large strong clamp is furnished for use when the tool is employed as a bench vise. It can be attached



STARRETT COMBINATION HAND AND BENCH VISE

to benches having thicknesses from ½ to 2⅛ in. The construction is such that the vise can be adjusted to any position throughout a complete circle, and then locked. The change from the bench mounting to the handle, and *vise-versa*, can be quickly effected.

The use of the ball-end handle for tightening the jaws, instead of a wing nut, enables bringing into play a large leverage, so that one objection to hand vises is eliminated.

The jaws of the vise are tempered and polished drop forgings, 1½ in. in width. They provide a maximum opening of about 1½ in. for the vise.

"Duraloy" Chrome-Iron Alloy

An alloy of chromium and iron known as "Duraloy" has recently been placed on the market by the Cutler Steel Co., Pittsburgh, Pa., with a general sales office in the Hudson Terminal Building, New York, N. Y. The chief feature of the alloy is resistance to oxidation, corrosion and abrasion, although it possesses other properties that adapt it to special uses.

The alloy can be furnished commercially in practically every form, including castings, rolled or forged bars, sheets, wire and tubing. The physical properties can be made to suit the conditions, varying with the analysis, treatment, and method of manufacture. Properties ranging from those somewhat better than cast iron to those of commercial alloy steels can be imparted to the metal. The uses for which the alloy can be employed are thus very numerous.

The metal contains a high proportion of chromium, but the content of chromium and of the other elements can be varied considerably, according to the properties that are desired. Duraloy castings are clean, close-grained and free from blowholes and segregations. They can be furnished in different degrees of hardness. In the rolled form the metal responds to heat-treatment in a manner similar to alloy steels. Bars or sheets can be supplied sufficiently ductile to permit of bending, punching, forming, and stamping. They are subsequently treated to increase the hardness and the wearing properties.

The Brinell hardness of the alloy can be varied from 170 to 600. The ultimate tensile strength of the cast alloy varies from 40,000 to 90,000 lb. per square inch, and of the rolled or forged alloy, from 80,000 to 130,000 lb. per square inch. A property of Duraloy that makes it adaptable in cases where severe service is encountered is the retention of a large precentage of its original tensile strength even at very high temperatures.

Although the machining qualities vary with the treatment given the steel, Duraloy can be furnished as easily machineable as medium carbon steel. Rolled sheets and bars can be readily machined after annealing. Castings can be supplied soft enough to permit of threading, tapping, drilling and other machining operations, but they can also be furnished so hard that it is possible to finish them only by grinding.

Duraloy can be welded by either the oxy-acetylene or electric arc methods, although it cannot be hammer welded. Preheating is found advantageous, particularly in the case of castings. Since the metal does not oxidize, it cannot well be cut by the oxy-acetylene cutting torch.

The alloy will resist oxidation up to 2,100 deg. F., and there is practically no loss of weight at this temperature. The metal does not warp nor crack at high temperatures, so that it is especially adapted for use as parts of furnaces and heat-treating equipment. It can be employed wherever high heat must be withstood, but at the same time physical strength is required. Examples of parts that must have such properties are gratings, doors and counterweight chain used for furnaces.

The alloy will resist atmospheric and salt corrosion indefinitely. It is especially resistant to nitric acid solutions, organic compounds and acid mine water, so that it can be employed for pump parts and apparatus for chemical plants. Since the alloy is resistant to anything of a highly oxidizing nature, such as molten cyanide and heat-treating salts, it may be employed for the lining of pots to hold such chemicals. The resistance to furnace gases varies with the nature of the gas. The alloy will take a high polish and is rust and stain proof. Pots and protective coverings made of it can easily be kept clean.

Both hardness and toughness are combined in the material, so that resistance to wear and abrasion is given. The wearing qualities are stated to be considerably better than those afforded by a steel having the same Brinell hardness. When prepared to give resistance to abrasion as its chief property, Duraloy is superior to the hardest chilled iron and to manganese steel, it is stated. Its properties in respect to abrasion makes it adapted for such uses as in balls and races for grinding, extrusion and drawing dies, liners for ore and coal chutes, and tips for piercing metal tubing. It is stated that the metal has been so tested in a variety of uses that its performance under different conditions can be readily predicted.

Bullard Automatic Machine for Boring Pipe Couplings

The production of the average small couplings used in pipe installations for steam, water and similar purposes would hardly be considered in the light of a difficult or complex shop problem; but when these couplings run to large sizes, 12 in. in diameter and larger, and the necessity exists for preserving exact alignment of the pipe sections joined by them—as, for instance, the casings of oil wells—the job of making them in the quantities necessary to meet the demand and with a degree of accuracy to fulfill the exacting requirements in the matter of alignment becomes one that is worthy of careful consideration by the designing engineer. The couplings are usually forged, or at least lap-welded, and in order to insure the alignment of the ends a boring operation is necessary before they receive the tapered threads into which the pipe sections are screwed. To meet the conditions and to attain a rate of production that is commensurate with the demand requires a machine especially designed for the purpose. Such a machine capable of taper-boring, counter-boring, facing to length and chamfering both ends of a coupling simultaneously, and of automatically loading and discharging the coupling as the work proceeds, without attention from the operator other than to keep the loading rack supplied with work and to clear away the finished pieces as they accumulate in front of the machine, is shown in the illustrations given herewith.

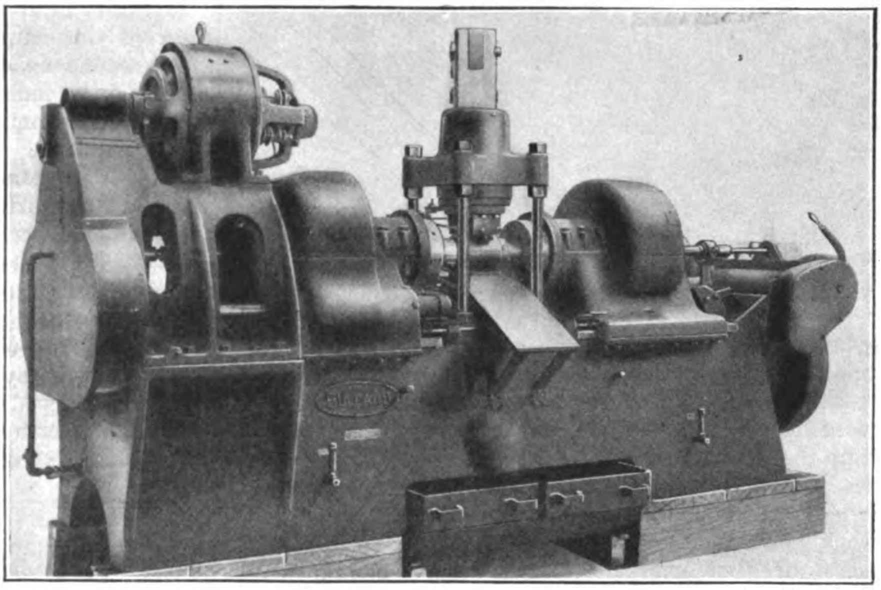


FIG. 1—BULLARD MACHINE FOR BORING LARGE PIPE COUPLINGS

The machine has been designed and placed on the market by the Bullard Machine Tool Co., Bridgeport, Conn. It is self-contained and is driven by two independent motors; the main drive a variable-speed motor of 25 hp. maximum, and the secondary drive a variable-speed motor of about 5 hp. A further requirement is a supply of air at a pressure of 75 to 80 lb. per square inch, that may be obtained from a small independent compressor or taken from the shop lines, as circumstances dictate.

A front view of the machine is shown in Fig. 1 with a 6-in. coupling in place in the jaws of the pneumatically operated chuck, and boring heads of corresponding size attached to the driving flanges, which form an integral part of the driving spindles at the inner end.

The main spindles are carried in substantial parallel bearings of bronze, 8 in. in diameter by 14 in. long, located in the two sliding heads. These heads have a longitudinal movement upon the bed, actuated by barrel cams directly under each head mounted upon a shaft that extends the length of the machine within the bed. The cams are so calculated as to cause the heads to advance to and recede from the work simultaneously. The rotative movement of the spindles is derived from the main driving motor, mounted upon the housing over one of the heads, and the speed of rotation is adjustable by means of the motor control to meet varying requirements imposed by diameter of work and toughness of material. The longitudinal shaft carrying the barrel cams that operate the heads derives its movement from two sources. During the slow advance of the heads when the tools are at work, the camshaft is driven by the main driving motor, and the rate of feed, therefore, automatically corresponds to the speed of rotation of the cutters. The ratio of feed to speed is susceptible to further variation by means of change gears which provide for faster or slower relative feeds.

After the tools have completed their cuts, the secondary motor furnishes the power for subsequent functions. The heads are withdrawn quickly, the air chuck opens, the loading mechanism operates to eject the finished piece and to replace it with an unfinished one upon which the chuck jaws close. These latter movements are controlled by dogs on the timing disk which is mounted on the end of the camshaft and power is transmitted through the camshaft by the secondary motor mounted upon a shelf at the rear of the machine. In Fig. 2, which shows the loading side of the machine, the air cylinder that operates the chuck may be seen mounted on the bed. The piston rod passes through both heads, being connected above through the medium of a lever of the first class to the upper chuck jaw, while below a lever of the second class transmits the movement to the lower jaw. Thus a single movement of the piston causes the jaws to withdraw in opposite directions, and a reverse movement again closes them upon the work.

No floating or compensating leverage is needed to bring the work to center. Once set central by means of the adjustments, any round piece must be exactly centered by the chuck because of the fact that the jaw movements to and from the center are equal and positive. The chuck could not grip in any other position, regardless of varying diameters. The work is held between the chuck jaws by air pressure alone. With a gage pressure of 80 lb., the gripping pressure upon the work is approximately six tons.

Air is admitted to and exhausted from the cylinder by means of a two-way valve located back of the bracket shown at the lower right in Fig. 3 and operated by the spring finger on the periphery of the cam disk. This cam is keyed to the protruding end of the longitudinal shaft that carries the barrel cams within the base of the machine. Besides the spring

finger, the position of which is fixed, there are circumferentially adjustable dogs upon this cam disk to operate a clutch tha. changes the drive of the camshaft from the slow feeding movement imparted by the main-drive motor to a fast traverse deriving its motion from the secondary motor, and *vice versa*. The

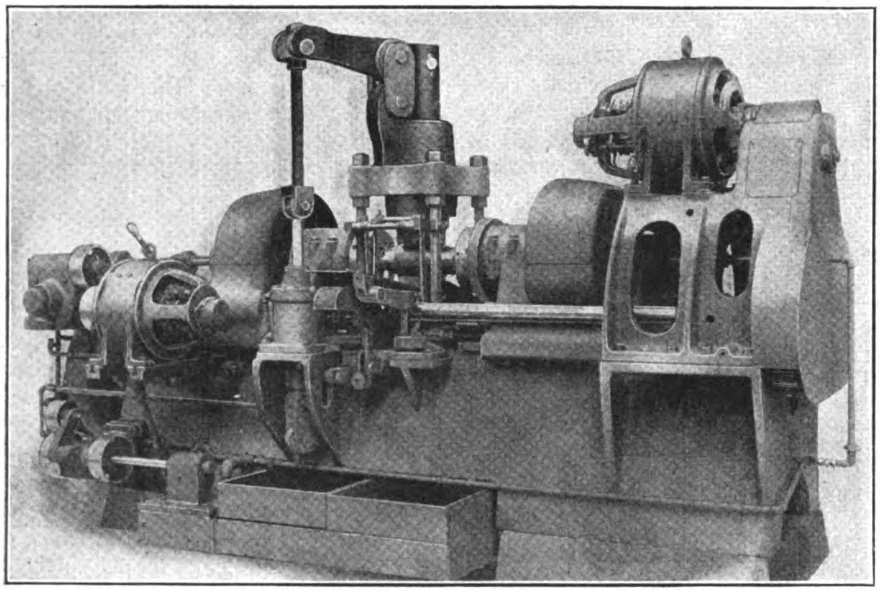


FIG. 2—REAR VIEW OF BULLARD MACHINE

clutch handle shown at the top enables the operator to, make this change manually at will, and to stop, start or maintain the rapid traverse in operation throughout the complete cycle independently of the cam, as may be desirable when setting up the machine or resetting tools.

The main spindles rotate in opposite directions at equal speeds and the heads advance to the work simultaneously. As the work performed by one cutter head is the exact duplicate of that performed upon the opposite end of the coupling by the other head, the pressures of both feed and cut are balanced and the chuck relieved of the duty of holding against excessive pressures. Ball thrust bearings upon each of the main spindles absorb the pressure of the cut and minimize frictional resistance.

Each cutter head is provided with three pairs of cutting tools made from standard $\frac{3}{4}$-in. square-sectioned bars of high-speed steel, stellite or other material, and these tools counterbore, face and chamfer the respective ends of the couplings. A fourth pair of tools in each head does the taper boring, and the manner in which this is accomplished is perhaps the most ingenious feature of the machine.

In each cutter head there are two diametrically opposed longitudinal slots, each slot carrying a swinging sector that is pivoted at the end next to the driving flanges and free at the other end to swing outward radially. At the outer end provision is made for holding a toolbit similar to the other tools. The main spindles (and also the cutter heads) are hollow, and through each there passes a former-bar that is square in section and tapered upon two opposite sides to correspond to the taper required in the work. The former-bars rotate with the cutter heads, but during the time of cutting they are held against endwise movement. The free ends of the swinging sectors in the cutter heads bear upon the tapered sides of the former-bars, and as the cutter heads advance the sectors gradually close together by reason of the pressure of the cuts upon the points of the tools. The taper of the bar is thus duplicated upon the inner surface of the work.

The cycle of operations of the machine is as follows: The chuck jaws close upon the coupling, the heads advance by rapid traverse to the beginning of the cut, and during this movement both former-bars are still more rapidly advanced by means of amplifying levers until they meet at the center of the work, where they are held in position.

One of the adjustable dogs on the timing disk shown in Fig. 3 now changes the movement of the camshaft and camdrum from rapid traverse to feed. The heads advance at feed toward the center of the coupling, one head slightly in advance of the other. The foremost head passes beyond the center of the coupling and as it retires, the second head continues to advance beyond the center overlapping the cuts to assure complete finish throughout the coupling. Camdrum speed now changes again to rapid traverse, quickly withdrawing the heads. The former-bars are returned with the heads, the jaws open and the loading mechanism operates to eject the finished piece.

The drive from the main motor to the spindles and camshaft is through gears of special alloy steel, heat-treated. All gearing is enclosed and runs in oil. The oiling system includes continuous oiling to main spindles and all important bearings. Special provision

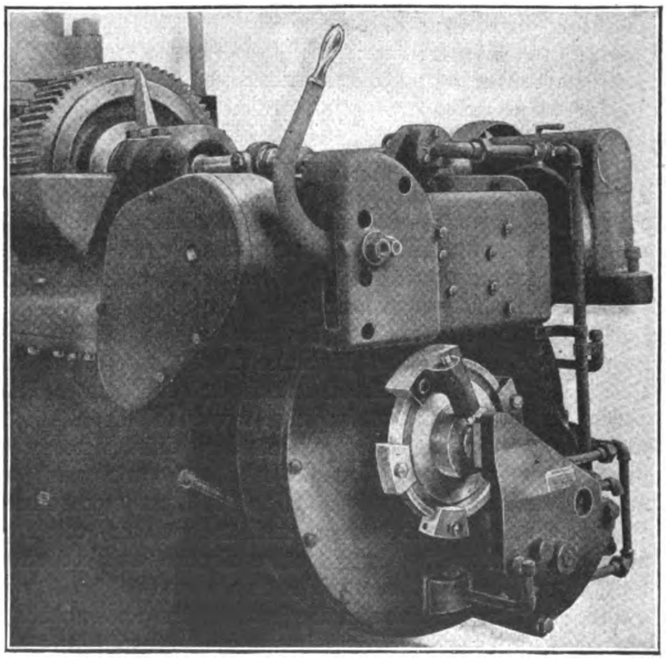


FIG. 3—THE OPERATING CAM

is made to exclude cutting compound from the bearings. The secondary motor drives the rapid traverse and automatic movements through an endless belt provided with a suitable belt-tightener. This motor also drives the pump for circulating the cutting compound.

The former-bars are hollow and are so connected at

their outer ends to the circulating system that two streams of ample volume are constantly delivered to the center of the coupling, serving the double purpose of lubricating the tools and washing out the chips. A tank for the cutting compound and removable pans for the chips are included in the equipment. The accessibility of the pans, which can be easily reached from either the front or the back of the machine, can be observed by referring to the first two of the illustrations.

Separate chuck jaws and separate cutter heads are required for each size of coupling. The cutter heads are attached by bolts and are keyed to the driving flanges and can be quickly changed. No other adjustment is required than changing chuck jaws and cutter heads for each size of coupling, and setting the adjustable dogs on the cam disk to make the speed and feed changes at the right instant.

The capacity of the machine is for couplings from 6 to $12\frac{1}{2}$ in. in diameter, pipe size. For the larger sizes the cutter heads are provided with four swinging sectors and the former-bars are correspondingly tapered upon four sides.

A variable-speed motor ranging from 400 to 1,600 r.p.m. provides for spindle speeds from 10 to 40 r.p.m. Change gears enable the feed ratio to be changed from 0.025 to 0.075 in. per revolution of the spindles. The machine weighs approximately 24,000 lb., occupies a floor space of 8x12 ft. and stands 5 ft. 6 in. in height.

"Commercial" Rust Remover and Pickling Compound

A preparation of foreign invention which is being used at the present time in Europe for the removal of rust and corrosion on all metals, as well as in sulphuric acid baths for pickling purposes, has recently been placed on the American market by the distributors, Peter A. Frasse & Co., Inc., 417 Canal St., New York, N. Y.

When cleaning metals or metal parts of rust or corrosion, one part of the "Commercial" rust remover to twenty-five parts of water is sufficient to loosen and remove any rust regardless of its age or condition. The part is merely immersed in a bath of the remover, and need not be heated nor scraped. Thus no labor nor mechanical treatment is required, so that the cost of removing the rust is slight. The bath works rapidly, so that the surface of the metal is soon left entirely free of corrosion.

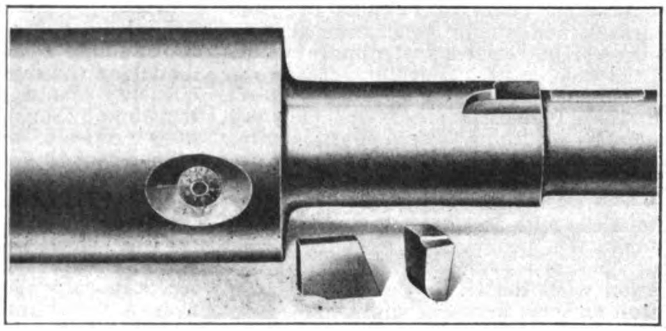
The rust remover does not consume nor attack the metal itself, as its action is entirely confined to removal of the rust and corroded portions. Thus, parts containing fine threads and teeth can be completely freed from rust without any decrease in size. The same solution can be used over and over, by merely adding a little of the compound occasionally. The cost of maintaining the bath is thus very low. The compound is not inflammable nor explosive, and hence can be used with safety near an open fire.

The "Commercial" rust remover and pickling compound is of particular use also in plants employing sulphuric acid and hydrochloric acid baths for removing scale. By the addition of 1 or 2 per cent of the compound to the bath, the formation of hydrogen, which is usually considered to cause pickling brittleness in steel, is prevented. The presence of the compound neutralizes the action of the sulphuric acid bath in consuming the metal which has already been freed from scale. It thus prevents loss occurring from overpickling. In the same way, a large saving of sulphuric acid required in the bath is effected.

Damage done to pickling apparatus, baskets, chains and equipment about the plant is considerably lessened by the use of the compound in the pickling bath. In addition, objectionable fumes from the bath are prevented. The compound may be furnished in quantities from one pint to that as large as desired.

Manufacturers' Equipment Co. Expansion Boring Bar

An expansion boring bar of simple construction, the working parts of which are shown in the accompanying illustration, has been developed by the Manufacturers' Equipment Co., Waller Ave. and Fillmore St., Chicago, Ill. It is stated that accuracy has been the first consideration in the design of the bar, and that the cutters can be adjusted to 0.0001 in. It is also stated that the



M. E. C. EXPANSION BORING BAR

cutters can be removed from the bar after setting and replaced without variation from size, which makes it possible to remove the cutters from the bar after a hole has been bored and replace them after the bar has been withdrawn from the hole, in cases where this is necessary. No care is necessary to return the cutters to the slots from which they were removed, as the same setting will be obtained by changing the cutters to opposite sides of the bar.

Micrometer adjustment is provided, each revolution of the dial indicating an expansion or contraction of the cutters equal to 0.010 in. As the cutters are moved outward in a direction at right angles to the axis of the shaft, practically all thrust is taken by the solid body of the bar. A radius on the back of each cutter fits into a corresponding seat in the body of the bar, a construction that tends to eliminate vibration or chatter. The locking mechanism consists of a tapered screw which forces a clamping block against the cutters, the block being so designed that the pressure is equalized, thus holding both cutters firmly in position.

The bar is made of heat-treated alloy steel, and the pilot is hardened to minimize wear. Cutter blades can be furnished in any kind of material desired; and they are of such simple design that they can be made in any shop. All working parts are of steel, hardened and ground, and will last the life of the bar. The mechanism is entirely inclosed in the bar in such a manner that no dirt, water nor oil can enter, and grease can be packed in the mechanism by removing a screw. Bars can be furnished in any size from $\frac{3}{8}$ in. up.

News Section

Mechanical Exhibit Will Have New Features

The first National Exposition of Power and Mechanical Engineering, to be held from Thursday, December 7th until December 13th, except for the intervening Sunday, will emphasize the need for greater power developments and fuel economies by the display of modern apparatus used in the combustion of fuels, in the production and use of power, and in the allied engineering arts. Competent engineers will be present at the various exhibits to explain the apparatus and to consult in its application to any particular problem.

The Exposition will be made up of an impressive array of exhibits of prime movers and steam generating devices, stokers, pulverized fuel apparatus, refractories, water purifiers, feedwater heaters, economizers, superheaters, blowers, valves, piping, pipe covering, pumps, recording instruments, belting and lubrication. All devices for the power house will be on show.

The educational features of the Exposition will be strengthened by the exhaustive program of motion pictures which have been secured in co-operation with the U. S. Bureau of Mines and various manufacturers, the titles of which are as follows: A Close-Up of Stoker Combustion, Making Vertical Transportation Possible, Everlasting Power: The Construction of the Caribou Hydro-Electric Power Plant in the Sierra Nevadas of California, Cottrell Electrical Precipitator in Action, The Story of Coal, The Story of Petroleum, The Story of Sulphur, The Story of Ingot Iron, Saving Coal at Home, The Story of Asbestos, Rock Drilling, The Story of Abrasives, The Story of Heavy Excavating Machinery, The Story of Natural Gas, Oxygen, The Story of an Electric Meter, The Story of a Watch, The Story of an Automobile, The Story of Steel, The Manufacture of Cast Iron Pipe, Water Power, and Electric Transportation.

The Exposition is to follow the Annual Meetings of the American Society of Mechanical Engineers and the American Society of Refrigerating Engineers. Invitations have been extended to these societies and also to the American Society of Safety Engineers, Stoker Manufacturers Association, American Institute of Electrical Engineers, American Economic Association, American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, Society of Industrial Engineers, Society of Welding Engineers, American Society of Heating and Ventilating Engineers, National Electric Light Association and the Building Managers and Owners Association.

The committee which is guiding the exposition consists of Irving E. Moultrop of the Edison Electric Illuminating Company of Boston, Chairman; Dexter S. Kimball, President of the American Society of Mechanical Engineers; Alexander G. Christie, Chairman Power Division A.S.M.E.; Fred Felderman, National President National Association of Stationary Engineers; Milan R. Bump, Past-President National Electric Light Association; N. A. Carle, Vice President Public Service Production Company of New Jersey; E. B. Katte, Chief Engineer Electric Traction N. Y. C. R.R. Company; Fred R. Low, Editor "Power"; David Moffat Myers, Consulting Engineer; Calvin W. Rice, Secretary the American Society of Mechanical Engineers, and the managers, Charles F. Roth and Fred W. Payne, with offices in Grand Central Palace, New York.

Federal Business Associations Are Being Formed

Under the direction of the Bureau of the Budget a definite effort is being made for the first time to increase the efficiency of our great federal business machine by bringing together, in the larger cities of the country, all officials of the Government in whatsoever department they are engaged. The work is under the personal supervision of General Herbert M. Lord, director of the Bureau of the Budget and Colonel H. C. Smither, his chief co-ordinator. According to the plan, Federal Business Associations are to be organized in the larger cities for the purpose of bringing about a closer co-operation and co-ordination in carrying on the Government's business.

In these associations it is expected that economies will be realized from the interchange of transportation facilities, the consolidation of purchases, the storage of supplies, and the co-ordination of many other activities to the common advantage of each of the different departments concerned. It is expected that the association will make possible the elimination of much duplication and a reduction in the expense of operation of the government.

The first Federal Business Association was formed in Chicago. At the organization meeting it was found that few Federal officials stationed in that city were acquainted with officials representing departments and bureaus other than their own. Other associations have been formed in Detroit, Milwaukee and Boston, and have already been in existence sufficiently long to prove their utility. It is now planned to carry the organization into Philadelphia, Baltimore and other large cities.

Ethan Viall Addresses Engineers at the University of Cincinnati

On Friday, November 10, Ethan Viall, Ohio editor of the *American Machinist*, gave a talk before three classes of engineering students at the University of Cincinnati. This revives and old custom which had been discontinued since Mr. Viall left Cincinnati some years ago to come to New York. Mr. Viall's talks have always been well received by the undergraduates.

Duluth Shipbuilding Plant Will Repair Railroad Cars

According to a report from Duluth, a company to be composed of Duluth and eastern capitalists is being organized to take over and operate the McDougall-Duluth shipbuilding plant in that city. The promoters propose to utilize the plant as a large railroad repair shop that would almost, at the outset, afford employment for from 2,000 to 2,500 men.

Capt. A. B. Wolvin has been engaged in the project during the last three months and he has received assurances that the Northwest railroads would furnish cars for repairs to the extent of $4,000,000 annually and terms upon which $2,000,000 worth of work would be carried through have been tentatively agreed upon. In addition, the plant has been guaranteed a large amount of marine work.

It was found upon examination by Capt. Wolvin and a party of engineers that the plant can be readily converted for railroad car repair shop purposes and that it would be available at once to undertake the repair of thousands of bad-order cars held by the Northwest roads. Figures obtained by the investigators showed that the original cost of the plant, built during the war period, was over $7,000,000; that its present replacement cost would be in the neighborhood of $4,000,000 and that it can be bought from its present owners, headed by Julius H. Barnes, at around $2,000,000.

A.E.S.C. Calls Conference on Numbering of Steel

A conference to consider the desirability of providing a system of designating qualities or kinds of steels by code numbers, has been called by the American Engineering Standards Committee at the request of the U. S. Bureau of Standards. The conference will be held in Room 704, Department of Commerce Building, Nineteenth Street and Pennsylvania Avenue, Washington, D. C., at 10 a.m., Dec. 6.

The subject of this conference is a matter of great importance to all manufacturers of steel and to all users of steel in large quantity. This conference will attempt to determine the desirability of applying a uniform numbering system to forging steels, casting steels, structural steels, including plates, tool steels or other steels not so classified.

While the American Engineering Standards Committee has invited to this conference representatives of all technical and industrial associations known to be interested in the subject, any organization which feels that it should be represented in the conference, but has received no formal invitation, is urged to communicate with the American Engineering Standards Committee, 29 West 39th Street, New York City.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

FOR the last two months or more in these letters it has been repeatedly pointed out that a period of secondary inflation was impending and that the logical effect would be an advance in commodities and a decline in the value of securities. Events have justified this prognosis, for stocks are on the average distincly lower than they were sixty days ago, and bonds have likewise declined. But most staple commodities, including cotton, wool, silk, rubber, wheat, sugar, hides and paper, have advanced.

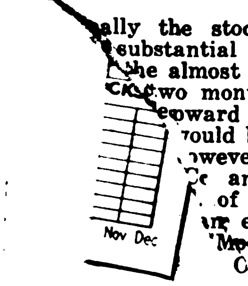
Because it has been under quasi-governmental control coal has not shared in the upward movement and a seasonal suspension of building operations, hastened by the railroad congestion, has held steel, copper and lumber in check.

Last week I called attention to the election of the progressive candidates in the Middle West and the power that they would wield in Congress by coalition or co-operation with the farmers "bloc." I suggested that the result might be some anti-capitalistic legislation or gestures that would lessen corporate profits and earning power.

A sub-conscious appreciation of this possibility seems to have been reflected in the stock market by the decline recorded last week. The word subconscious is advisedly used, for most of those who speculate in stocks thoughtlessly follow the few unseen and often unknown leaders who really think and act upon conviction.

As to whether these major influences will be unremittingly operative no one can say. They are as yet chiefly psychological in their incidence. They have affected the minds of habitual speculators and led students of economic affairs to revise their opinions, but the great mass of the people have not thus far sensed their significance, and the usual trade reports indicate an uninterrupted flow of business.

Most merchants are therefore expecting an active Christmas season with large sales, and one very prominent dry goods dealer in the Middle West wrote me last week that he looked for "a mild prosperity that would last until next autumn." He may be right, but much depends upon what the present Congress does when it resumes work Nov. 20 and whether President Harding calls the new Congress together before December, 1923, prior to which te it will not otherwise convene.



ally the stock market should substantial reaction upward he almost continuous decline wo months, and normally ward movement of com- ould be in order.

owever, unusual times. and the post war of the United States economic questions popular magazines have found that their readers were as much interested in commercial and financial articles as they were formerly in short stories. The newspapers are devoting more space than ever before to business reports and throughout the entire country there is a quickening of interest in the operation of economic law.

It is therefore possible that the interval between cause and effect in business may be shortened and that having become mentally more alert men will more promptly discount a change.

Some years ago Frank Vanderlip said we were a nation of economic illiterates. The statement is no longer true. We have learned at least the A. B. C. of economic science but a little learning is a dangerous thing and it remains to be seen how we will apply the rudimentary knowledge that we have latterly acquired.

> **The unrest of the people as expressed in the recent elections is a factor to be reckoned with. It is only four years since the armistice, and until the wounds of the world war are healed it is altogether probable that we shall have recurring spells of economic aberration to disturb us, just as our fathers were vexed by the Greenback craze of the 1870's which followed the Civil War.**

Upon the theory that what we have learned will make us cautious about going to extremes I should say that for the immediate future stocks are low enough and commodities about as high as they are likely to go except as they may be affected by special rather than general influences.

But we must not deceive ourselves. The unrest of the people as expressed in the recent elections is a factor to be reckoned with. It is only four years since the armistice, and until the wounds of the world war are healed it is altogether probable that we shall have recurring spells of economic aberration to disturb us just as our fathers were vexed by the Greenback craze of the 1870's which followed the Civil War.

The expectation of some such movement has become so general that it has been already christened the "new liberalism" and there are many guesses as to who will be its leader. Borah, La Follette, Hiram Johnson and Brookhart are among those named, but Henry Ford is mentioned oftener than others.

Speaking in New York last week Carl Ackerman asserted that Ford was the financial backer of the Farm Labor movement and that he had spent more money in the last campaign than any other person in the country.

Inasmuch as business thrives only when conditions are reasonably stable a boom is not to be expected when the outlook is so uncertain. In writing thus I do not mean to be pessimistic. My purpose is rather to avert the consequences of the probable by counseling preparation.

In Europe confusion again prevails. The news from England indicates that Lloyd George has been badly defeated and a new pilot for the British ship of state must be selected. The tories are elated, but from a non-partisan standpoint the political uncertainty seems to be increased.

Germany appears to be rapidly approaching the Niagara of deflation and now that the mark is worthless she may be carried over the falls at any moment. The Reichsbank has advanced the discount rate to 10 per cent and the ministry headed by Chancellor Wirth has resigned.

French francs are still under seven cents, French dollar bonds are weak and lower in New York and it looks as if another internal loan would be necessary to balance the French budget. All this suggests a further reduction in the purchasing power of Europe that will not help our export trade.

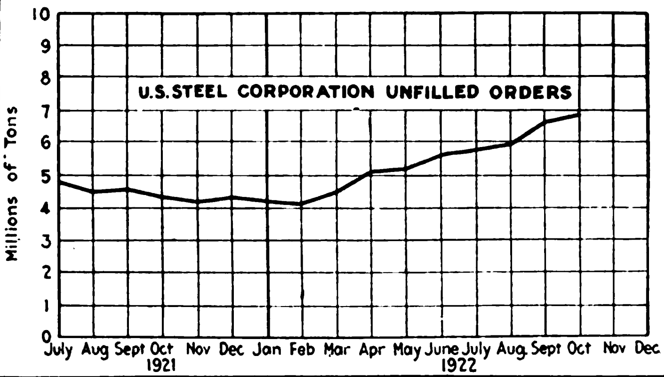
The Turko-Allied imbroglio about Constantinople is beyond American ken, but it is doubtful whether it is as serious as the newspapers would lead one to suppose. The brightest spot in the world this week is the Argentine, where a boom based upon the excellent crop prospects seems to be developing.

But the good news from the Argentine is somewhat obscured by the Chilean earthquake and its toll of death. Conditions in Cuba appear to be better. A good sugar crop is promised upon the strength of which the long deferred loan of 50 million dollars will probably be arranged. But as an offset an important bank failure is reported from Mexico.

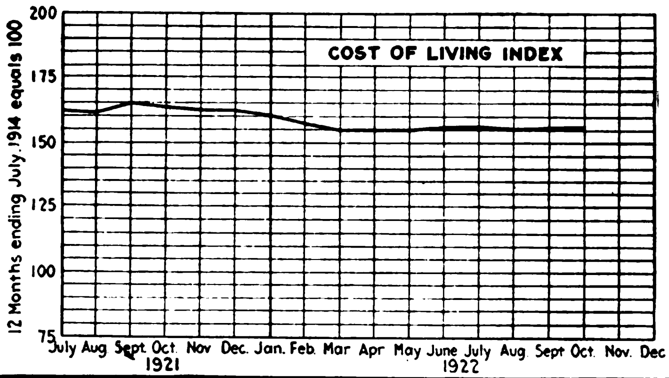
On the whole the outlook is spotted. Good here and bad there. The weekly statement of the Federal Reserve System shows a decline of 1.2 per cent in the reserve ratio, which stands at 75.2 as compared with 76.4 a week ago. The gold supply is reduced by about $7,000,000 as a result probably of exports to Canada as well as of the continued disbursements of yellow-backs by the banks. The other changes are not important.

The money market is firmer and 4½ per cent is the lowest rate at which the very best commercial paper can be sold. Rates are tending upward, chiefly because the railroad congestion delays the distribution of goods in transit.

Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.



Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.



UNFILLED ORDERS on the books of the U. S. Steel Corporation on October 31, 1922, totaled 6,902,287 tons as compared with 6,691,607 tons on September 30. The tonnage on order at the close of October represents the largest total at the end of any month since February, 1921, at which time unfilled orders totaled 6,933,867 tons. Beginning with March of the current year, an increase has been shown in each thirty-day period ranging from 140,630 tons in July to as high as 741,502 tons during September. Railroad requirements and building construction demands continue as the chief features of the increase.

Metal product shares in the New York stock market advanced during October, the average price of ten representative issues reaching $79.50 per share as against $77.23 per share in September. The month was marked by an advance to an average of $83.15 per share for the week ending October 23, from which point there was a gradual decline to $76.80 for the week ending October 30. The chief features were the shares of the can and electrical companies all of which have a large volume of business on order.

Railroad rolling stock condition attracted no little attention during the month of October, chiefly on account of the car shortage which has been mounting upward rapidly for the past few months. With 141,252 cars short of requirements on American roads for the week ending October 8, the increase has continued until it reached the record shortage of 179,239 cars on October 31. The average for the month was 160,787 cars as against the September average of approximately 100,000 cars. Car surplusage declined in corresponding proportion, the average for the month being 4,475 as against 21,000 in September. Cars in bad order decreased from 321,674 or 14.1 per cent of the total to 249,960 or 11 per cent. Heavy demands upon the railroads for cars for coal, grain and merchandise loading continued during the month.

Comparative Prices of Shop Supplies

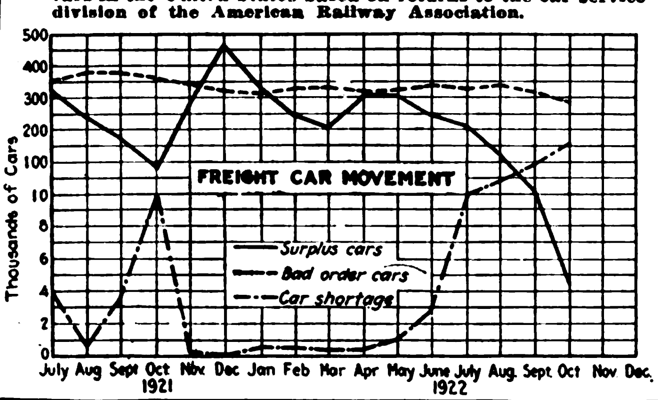
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0295	$0.0295	$0.0273
Cold finished shafting......	per lb.........	0.0378	0.0378	0.0373
Brass rods.....	per lb.........	0.171	0.1700	0.15
Solder (½ and ½)	per lb.........	0.24	0.23	0.20
Cotton waste..	per lb.........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal.......	0.59	0.575	....
Machine oil....	per gal.......	0.36	0.36	....
Belting, leather, medium......	off list........	30–10% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

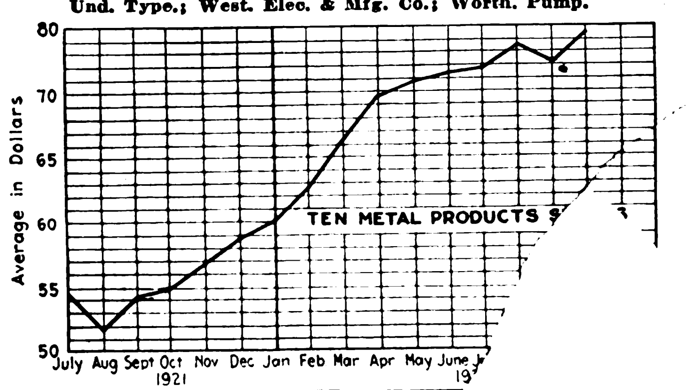
Cost of living among wage earners' families in the United States on October 15, was 57.1 per cent higher than in July, 1914, according to figures collected by the National Industrial Conference Board. Between September 15 and October 15 there was an increase of 1.5 points or one per cent. The changes in the budget within the month were continued slight increases in the average cost of food, clothing and coal. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and October, 1922, the cost of living dropped 47.4 points or 23.2 per cent.

Commercial failures in the United States last week, according to reports furnished by Bradstreets, numbered 378 as compared with 374 in the week previous and 474, 307, 110 and 132 for the corresponding weeks of 1921 and 1918.

Monthly average of car shortage surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West. Elec. & Mfg. Co.; Worth. Pump.



David J. Joseph Co., Cincinnati, Ohio. Mr. Foster has been head of the John B. Foster Co. of Cleveland and formerly was connected with the National Trading Co. of that city. He will make his headquarters in Youngstown, Ohio.

A. H. HUNTER, president of the Atlas Steel Corporation, has resigned. Mr. Hunter will retain his stock interest in the corporation.

W. H. WARREN, formerly general manager of the Brier Hill Steel Corporation, Youngstown, Ohio, has been named general superintendent of the Trumbull Steel Co., at Warren, Ohio.

JOHN F. MILLER, vice-chairman of the board of directors of the Westinghouse Airbrake Co., Wilmerding, Pa., has been elected a member of the board of trustees of the College of Wooster, Ohio.

RAYMOND K. BOWDEN has been appointed instructor in metallurgy at the Carnegie Institute of Technology, Pittsburgh, Pa. Mr. Bowden was formerly with the Central Steel Co. of Massillon, Ohio, and the Crucible Steel Co. of America at Pittsburgh.

HARRY W. IRWIN has accepted the position of the superintendent of the Universal Steel Co. at Bridgeville, Pa. Mr. Irwin came to Canton in 1901 and entered the employ of the Stark rolling mill. For several years he was superintendent of the Canton Sheet Steel Co.

C. C. UPHAM, chairman of the board of directors of the Diebold Safe and Lock Co., Canton, Ohio, has been elected president of the company to fill the unexpired term of the late John C. Welty. Mr. Upham will continue to serve as chairman of the board.

O. E. QUERE, formerly with the Niles Steel Products Co., Niles, Ohio, has been appointed assistant general manager of sales of the Ashtabula Steel Co., at Ashtabula.

A. E. HUGHES, for the past eight years connected with the Brier Hill Steel Co., Youngstown, Ohio, and lately superintendent of the Western Reserve plant at Warren, has resigned to become general superintendent of the Ashtabula Steel Co., at Ashtubula, Ohio.

L. L. ROGERS has resigned from the position of manager of the advertising and printing department of the New Home Sewing Machine Co., Orange, Mass.

ADDRESS WANTED

Will anyone knowing the whereabouts of William H. Addis, formerly connected with the Link Belt Company, Indianapolis, and later located in Los Angeles, communicate with Mr. B. Rich, 1043 East 12th St., Brooklyn, N. Y.

Obituary

CHARLES E. HERRICK, for many years proprietor of the Herrick Machine Co., and for some time manufacturer of the Nonotuck bicycle, at Northampton, Mass., died in that city Oct. 10 at the age of 79 years.

GEORGE F. SMITH, at one time vice-president of the H. D. Smith and Co., Plantsville, Conn., and one of the best known manufacturers of Connecticut, died at his home in Southington, Conn., November 12, at the age of 92 years. For the past few years Mr. Smith has led a retired life.

VIRGIL F. SCHWAIN, for six years superintendent of the Atlantic Foundry Co., Akron, Ohio, died recently at his home in that city at the age of 45.

CHARLES G. COOPER, founder of the C. G. Cooper Co., machinery manufacturer, died recently at his home in Mt. Vernon, Ohio.

JACOB F. SNYDER, vice-president of the Hess-Snyder Co., machinery manufacturer, died at his home in Massillon, Ohio, recently. Mr. Snyder, who was 77 years of age, was one of the pioneers in the Massillon steel and machinery industry. He entered the manufacturing business in 1872 when he became associated with F. H. Snyder and Bros., in operating a general foundry. Ten years later the firm of which he was a member consolidated with J. H. Hess and Bro., furnace manufacturer.

FRANK ENGELHARD, proprietor of the Hercules Float Works, Springfield, Mass., died in that city Oct. 31, at the age of 79 years. He had taken out thirty patents for copper floats, automatic lighting devices, electroplating apparatus, etc.

Pamphlets Received

Union Scale of Wages and Hours of Labor, May 15, 1921. Bulletin No. 302, of the Bureau of Labor Statistics, U. S. Department of Labor, just issued, contains the union scale of wages and hours of labor of 930,903 members of organized trades and occupations in 66 of the principal cities of the United States, as of May 15, 1921.

The Interallied Debts as a Banking Problem. The Cnase National Bank, New York City, has just published its economic bulletin No. 5, of Vol. II in which the Interallied Debts from the standpoint of a banking problem are discussed by Benjamin M. Anderson, Jr., Ph.D., Economist of the Chase National Bank. Interesting points of view are given on the debt funding commission, the manner in which the banker views the reparations, international payments through the export of goods and a discussion of the recent statements of Mr. McKenna and Mr. Hoover on the great question.

Budgeting for Business Control. This pamphlet just issued by the U. S. Chamber of Commerce, asserts that the main object and purpose of a budget is to secure internal control of a business. The manufacturer, it is declared, is taking a big step forward to that end if. at the beginning of the year, instead of entering the new period without definite plans or purpose, he charts his course as far as possible through the compiling of a budget. Copies of the pamphlet may be had by addressing the Fabricated Production Department, Chamber of Commerce of the United States, Washington.

The Western European Division and American Business. A small folder describing the organization of the Western European Division of the Department of Commerce, its functions and the aids which it can extend to American manufacturers. Published by the Bureau of Foreign and Domestic Commerce, Washington, D. C.

China Trade Act, 1922. Trade Information Bulletin No. 74 of the U. S. Department of Commerce contains the China Trade Act and sets forth the regulations and forms for application for certificate of incorporation, certificate of property value, certificate of amended articles of incorporation, certificate of authorization for dissolution, certificate of authorization for extension and annual reports.

Foreign Trade of the United States for the Fiscal Year 1921-1922. Trade Information Bulletin No. 59 of the U. S. Department of Commerce, prepared by the Division of Research and just issued, contains complete statistical data on the foreign trade of the United States for the fiscal year 1921-1922.

Trade Catalogs

Screw Machines. Brown & Sharpe Manufacturing Co., Providence, R. I. The company is now placing before the trade its new screw machine catalog No. 23-G, of 197 pages, just off the the press, in which is described its complete line of automatic, wire feed and plain screw machines, their attachments and tools. The arrangement of this catalog is entirely new and the arrangement is excellent. The detailed descriptions of the automatic, wire feed and plain screw machines are arranged in this order in the first part of the book. Following the descriptions of these machines there are condensed tables of general specifications in a form which will prove convenient for comparative purposes. Next, in order, are complete specifications of all styles and sizes of machines, arranged in the order mentioned above. This grouping of specifications in one section instead of having them distributed throughout the descriptive matter should prove an advantage in finding any desired specification.

Industrial Helical Gears. The R. D. Nuttall Co., Pittsburg, Pa. A new publication of nineteen pages, known as Bulletin No. 34 has just been issued by this company. With an excellent arrangement, the publication describes the Nuttall Helical gears for industrial service and gives illustrations of characteristic installations. Booklet 36 of this company, which is also a new publication, is entitled "Proportion of Industrial Gears." This publication is one of exceptional value, as it makes possible for an engineer, the calculation of the sizes of gears for any given drive. Eight double page charts are bound into the booklet for use in making calculations.

Duraloy. The Cutler Steel Co., Pittsburgh, Pa. This company has just issued a new folder, known as Bulletin No. 221 describing its Duraloy product, a chromium iron alloy. The product is the result of a development to produce a low cost alloy to resist oxidation. The bulletin contains a complete general description of the alloy, setting forth its physical properties.

Forthcoming Meetings

National Founders' Association, Fall meeting, Hotel Astor, New York City, Nov. 22 and 23. Secretary, J. M. Taylor, 29 South LaSalle St., Chicago, Ill.

Taylor Society, Annual meeting, November 22, 23 and 24, 1922, at Engineering Societies Building, 29 West 39th St., New York City.

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16, Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association. Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Society for Testing Materials, Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Zinc, in carlots, 7⅞c. as against 7¾c. per lb. in New York warehouses. Copper tending upward. Lead quiet but prices firm. Aluminum ingots, ton lots, advanced 2c. per lb. during week. Scrap brass, heavy, up 3¼c. in Cleveland, despite declines in dealers' purchasing prices of old metals, in that market.

Demand quiet for steel structurals, but prices firm at $2 per 100 lb., base. Plate inquiries better, however, principally for tank construction; quotations, $2@$2.10, f.o.b. Pittsburgh.

Declines—Pig iron, coke and scrap prices all tending downward. No. 2 foundry iron down $3.27 at Pittsburgh and $4.50 per ton at Birmingham. Tin, 36⅞c. as compared with 38c. per lb. at New York warehouses. Scrap copper, light brass and No. 1 yellow brass turnings, down ¼c. per lb. in Cleveland.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.55
Northern Basic	31.27
Southern Ohio No. 2	31.71
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	33.27
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	31.14
Virginia No. 2	37.17
Basic	28.26
Grey Forge	29.64
CHICAGO	
No. 2 Foundry local	30.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	28.50
Basic	28.00
Bessemer	31.00

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.75	4.19	3.70	4.00
No. 12	2.60@2.85	4.24	3.75	4.05
No. 14	2.70@2.90	4.29	3.80	4.10
No. 16	2.90@3.20	4.39	3.90	4.20
Black				
Nos. 17 and 21	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized				
Nos. 10 and 11	3.35@3.60	4.90	4.40	4.85
Nos. 12 and 14	3.45@3.70	5.00	4.50	4.95
Nos. 17 and 21	3.75@4.00	5.30	4.80	....
Nos. 22 and 24	3.90@4.15	5.45	4.95	5.45
No. 26	4.05@4.30	5.60	5.10	5.55
No. 28	4.35@4.60	5.90	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
3/32	8.00		12@13
⅛	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.25
Tin, 5-ton lots, New York	36.87½
Lead (up to carlots), St. Louis.....6.90@6.95; New York	7.50
Zinc (up to carlots), St. Louis.....7.35@7.40; New York	7.87½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	22.70	23.00	23.00
Antimony (Chinese), ton spot... 7.25@7.37½	8.50		7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.50	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.75	9.25
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	6.50	6.75	7.00
Zinc	3.00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 20x28, 112 sheets	20.00	18.25	18.50
IX, 20x28, 112 sheets	23.00	21.00	20.90
"A" Grade:			
IC, 20x28, 112 sheets	17.00	16.00	17.00
IX, 20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright			
Prime, 20x28 in.:			
100-lb., 112 sheets	12.50	11.00	14.50
IC, 112 sheets	12.80	11.40	14.80
Terne Plate			
Small lots, 8-lb. Coating:			
100-lb., 14x20	7.00	6.00	7.25
IC, 14x20	7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.93	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.75	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville...per net ton		$7.25@7.50	
Coke, prompt foundry, Connellsville...per net ton		8.00@9.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in x 30 in	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅞ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.60	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Fla., St. Petersburg—T. D. Orr—machine shop equipment.

Ga., Atlanta—R. M. Dodd, 12 Walton St. (machinery)—one wood turning lathe and one power drill.

Ill., Chicago—Chicago Metallic Mfg. Co., 542 West 35th St.—vertical miller and surface grinder with magnetic chuck (used preferred).

Ill., Chicago—Chicago, Milwaukee & St. Paul Ry. Co., Ry. Exchange Bldg., G. H. Walder, Purch. Agt.—two 30 in. full swing, side carriage turret lathes, 9 in. hole through spindle, equipped with four-jaw extra heavy Universal chuck, with complete set of chucking and bar tools, arranged for motor drive; one 2½ x 6 in. cone drive flat turret lathe with 4 tool holders; one 24 in. x 10 ft. engine lathe arranged for belt drive; one 18 in. x 8 ft. heavy duty geared head engine lathe, arranged for belt drive; one 2½ x 26 in. rigid turret, oone drive flat turret lathe with 4 tool holders; one 18 in. x 8 ft. heavy duty geared head engine lathe; one 36 in. x 18 ft. heavy duty triple back geared instantaneous change gear engine lathe; one 44 in. heavy duty motor driven driving box boring mill; one 54 in. vertical adjustable rotary milling machine; one 48 in. x 12 ft. horizontal milling machine; one extra heavy double pinion-drive heavy duty vertical boring and turning mill to take 62 in. under tool holders, spindle travel 42 in., arranged for variable speed motor drive; one 36 in. heavy duty draw cut shaper arranged for motor drive; one 36 in. motor driven heavy duty draw cut pillar shaper; one 28 in. heavy duty back geared crank shaper arranged for single pulley drive; two 86 in. heavy cabinet base, automatic guide bar grinders, sectional wheel, equipped with T slot carriage 2 speeds, 32 in. steel chuck and sectional wheel, arranged for motor drive; one motor driven 90 in. locomotive journal turning, quartering and pin turning machine; one 15 ton, 30 ft. span electric traveling crane (used); one motor driven 1½ in. wedge grip bolt and rivet header; one electric flue welder; one 1,100 lb. single frame guided ram steam hammer; one 60 in. high duty, single pulley drive Universal radial drill.

Ill., Chicago—L. G. & Machine Co., 6008 State St.—stamping and dies, also machinery for making same.

Md., Forest Hill—G. W. Morse & Sons—one heavy duty boring machine.

Mass., Boston—C. Lerner, 827 Shawmut Ave.—machinery, small tools and equipment for proposed garage.

Mass., Boston —. Richardson, Wright & Co., 65 Beverly St. (manufacturers of metal furniture)—drill press with 20 in. lever feed, round base (used).

Mass., Peabody—D. Bertholdi, c/o G. A. Cornet, Archt., 10 Central Ave., Lynn—equipment for proposed $25,000 machine shop on Wilson Sq., here.

Mass., Turners Falls—John Russell Cutlery Co.—one ring wheel grinder, Springfield No. 58, or similar machine.

Mass., Weymouth—Brooks-Skinner Co.—machine shop and sheet metal workers' tools for proposed factory for the manufacture of metal garages.

Minn., St. Paul—All-American Steel Casket Corp., c/o J. A. Burrichter, Church and St. Peters Sts.—machine tools for the manufacture of steel caskets, etc., for proposed factory at Nichols.

N. Y., Buffalo—E. E. Harris & Co., 22 Maurice St.—equipment, including 1,000 gal. gas tank and pump, for service station on Kensington Ave.

N. Y., Geneva—J. J. Pole—lathe to swing 18 in. for both spinning and turning, punch press, grinder and polishing jack.

Pa., Allenton—H. Seip, 260 East Walnut St.—one press drill.

Pa., Lancaster — H. Hugh, Lime and Chester Sts.—machine and repair shop equipment.

Pa., Phila.—W. Wilson, 14 South 17th St. (machinist)—Star screw cutting lathe with motor.

Pa., Warren—Union Oil Co., West End—machinery and tools for large garage and service station.

Tenn., Memphis—Memphis Machine Wks., 171 Vance Ave. (heavy iron and machine work, saw mill and other mill machinery)—machinery for proposed addition to plant.

Va., Richmond—Chesapeake & Ohio R.R., 825 East Main St., R. M. Nelson, Purch. Agt.—one lathe, 6 x 16 in. bed, Lodge & Shipley (or its equal); one 3 x 36 in. Jones & Lamson flat heat turret lathe, motor driven, complete with motor leg and idler; one painting tool; one centering tool; one drill chuck; one 2 in. automatic die with 9 sets of chasers; one openside turner; one 14 in. 3 jaw chuck; one 3 jaw special chuck; one 20 x 10 in. bed, Lodge & Shipley lathe (or its equal), complete with direct connected motor drive by short volt, motor to be wound for 440 volt, 3 phase, 60 cycle General Electric or Westinghouse with starting switch; one 24 x 10 in. bed, Lodge & Shipley lathe (or its equal), complete with direct connected motor drive by General Electric or Westinghouse 440 volt, 3 phase, 60 cycle a.c. motor.

Va., Richmond—McCooks Machine Wks., 906 East Cary St., A. McCook, Purch. Agt. —lathe, drill press, cylinder grinder and other machinery.

Va., Richmond—Trowbridge & Bowery, 1540 East Cary St. (automobile repairing) —lathe, drill press and bench vise.

Va., Richmond—White Motor Repair Co., 1919 East Franklin St.—arbor press and air pressure system for cleaning.

W. Va., Buckhannon—Belgrade Glass Co.—machine shop equipment to replace that which was destroyed by fire.

W. Va., Shinnston—Alley Glass Co.—machine shop equipment.

Wis., Appleton—Manthey & Puth, Washington and Morrison Sts.—automobile repair machinery for proposed $40,000 garage on College St.

Wis., Conover—G. C. Dobbs—automobile repair machinery for new garage.

Wis., Green Bay—J. A. Piaskowski, 445 South Jackson St.—automobile repair machinery for proposed $40,000 garage.

Wis., Milwaukee—P. O. Erdmann, 708 12th Ave. (automobile repairs)—drill press and emery wheel.

Ont., Tilsonburg—Wilkie Products Co., 312 Pitts St.—tools and metal working machinery for the manufacture of automotive specialties.

Ont., Windsor—The Windsor Tool & Machine Co.—machinery for the manufacture of tools for proposed machine shop at Tilsonburg.

Machinery Wanted

Calif., Fresno—W. M. Murphy Motors Co., 1919 Calaveras St.—overhead traveling crane for automobile repair shop on Van Ness Ave.

Conn., Bridgeport—M. J. Dowling & Co., 576 Gurdon St., (building specialties)—complete small printing press outfit (new or used).

Conn., Dayville (Killingly P. O.)—Assawaga Woolen Co.—machinery for addition to mill.

Conn., Hartford—Bacon Bottling Wks., Morris St.—bottling equipment for new plant.

Conn., Hartford—Hartford Despatch & Trucking Co., 105 Albany Ave., A. Mooney, Purch. Agt.—conveying equipment for proposed warehouse.

Conn., Hartford—United Bottling Wks., 75 Chestnut St.—bottling equipment for new plant.

Fla., McIntosh—McIntosh Utilities, Inc., N. A. Russell, Treas.—machinery and equipment for proposed $50,000 cold storage and refrigeration plant.

Ga., Brunswick—Maritime Industries Co. —one 72 in. diameter, log, cut off saw; one Mandrell topsaw, 2 $\frac{7}{16}$ in. x 8 ft.; also conveyor chains ¾ x 6.

Ga., Macon—T. L. Ross Lumber Co.—complete portable saw mill outfit, slab burning boiler preferred.

Ga., Rome—Battey Mchy. Co., West 2nd Ave.—10 ton steam roller machine to develop 15 hp.

Ill., Chicago—Aetna Sand & Gravel Co., 11 South La Salle St.—stone crusher, one 18 x 72 in. boiler for steam, and one 12 x 54 in. locomotive boiler.

Ill., Chicago—Commercial Battery Box Co., 2054 Clybourn St.—16 or 18 in. planing machine.

Ill., Rockford—Washburn Co., 1802 Preston St.—iron working machinery.

Ind., Fort Wayne—The Fort Wayne Corrugated Paper Co., Murray and Barr Sts.—machinery and equipment for proposed plant at Hartford City.

Kan., Arkansas City — Arkansas City Sand Co., Home Natl. Bank Bldg., N. C. Dunn, Purch. Agt.—one yard revolving shovel.

Kan., Augusta — A. M. Crain (cabinet maker)—scroll saw.

Kan., Wichita—Crouse Clear Vision Gasoline Pump Wks., 822 East Harry St., E. Crouse, Purch. Agt.—furnace for 16 x 40 ft. foundry for making castings.

Kan., Wichita — Wichita Tribune, 2401 Rosenthal St., P. Elgin, Purch. Agt.—small power newspaper press.

Ky., Louisville — Gibbs-Inman Co., 825 West Bway.—machinery and equipment, including motors, transmission equipment, etc., for $110,000 printing plant.

La., Baton Rouge—A. J. Rodriquez, 702 St. Ferdinand St.—machinery and equipment for the manufacture of spring wheels for automobiles and auto trucks.

Mass., Hyde Park (Boston P. O.)—B. R. E. Mfg. Co. (woodworkers' and plumbers' specialties)—conveying machinery, etc., for new kiln at 53 Walter St.

Mass., Millbury—The Felters Co., West St. (woolen mills)—machinery and equipment for new dyehouse.

Mich., Detroit—Bd. Educ., 1354 Bway. Ave., C. A. Gadd, Business Mgr.—one wood trimmer with stand to cut 4½ in. deep and 8½ in. long, equal to Fox 4A or Oliver 9; one 14 in. single geared crank shaper or back geared shaper; one saw guard for 18 in. circular saw, to be mounted on iron table.

Mich., Detroit—C. B. Bohn Fdry. Co., 3651 Hart Ave.—equipment for proposed addition to foundry.

Mich., Detroit—United States Radiator Corp., 133 Grand River Ave. and Corry, Pa.—cupola blower.

Mich., Muskegon—The Central Paper Co. 42 in. x 1,500 ft. steel watering tank, 30 steel tanks, belt conveyors, hand operated cranes, steel sash and rolling steel shutter.

Minn., Minneapolis—Carter-Mayhew Mfg. Co., 607 5th Ave.—electric traveling crane.

Minn., Red Wing—Red Wing Milling Co. (flour milling, etc.)—modern power milling machinery for branch at Brodhead, Wis.

Miss., Lumberton—Ashbrook Veneer Co., C. Ashbrook, Pres.—rotary cutters, transmission machinery and other lumber and veneer mill equipment, including electric motors.

Mo., Carthage—J. J. Ansell & Co. (planing mill)—pony planer, sawing machinery, belting, sander, hangers and bearings.

Mo., St. Louis—Johnson, Stephens & Shinkle Shoe Co., 4242 Laclede Ave.—equipment for shoe factory at 4264 Laclede Ave.

N. J., Gloucester City—Superior Thread & Yarn Co.—three 40 in. revolving flat cotton cards; two 40 in. revolving flat breaker cards with automatic feeds.

N. Y., Buffalo—Boehm Bros., Inc., Niagara Life Bldg.—machinery and equipment for carpenter shop at 101 Norfolk St.

N. Y., Buffalo—Culliton Ice Cream Co., 172 Guilford St.—machinery for ice plant on Halbert St. and Jewett Ave.

N. Y., Buffalo—E. J. Emanuel, 464 William St.—candy making machinery for factory at 3178 Bailey Ave.

N. Y., Buffalo—Island Warehouse Co., Ganson St. and City Ship Canal—machinery and equipment for proposed $500,000 flour mill.

N. Y., Buffalo—A. Plotkin, 1040 Elmwood Ave.—woodworking and light manufacturing machinery for proposed small shop at 70-72 East Eagle St.

N. Y., Buffalo—R. W. Sellers, 170 Auburn Ave.—candy making machinery for factory at 442 Niagara St.

N. Y., Buffalo—Urban Milling Co., 200 Urban Ave., G. B. Urban, Pres.—machinery and equipment for packing and storing flour.

N. Y., Elmira—W. Jenkins, Lower Maple Ave.—quantity of (good) 8 in. leather belting.

N. Y., Elmira—H. Sutter, 428 Erie St.—machinery and equipment for the manufacture of radio apparatus.

N. Y., Fayetteville—Manlius Publishing Co.—magazine for model K linotype (used).

N. Y., Rochester—L. P. Gunson Seed Co., foot of Ambrose St.—machinery and equipment for addition to seed plant.

N. Y., Syracuse—Onondaga Litholite Co., 102 Beech St. (manufacturer of composition stone products)—machinery and equipment for one story addition to plant.

N. Y., Wellsburg—W. Walsh—one power, belt driven hay pressing machine.

O., Cleveland — A. S. Gilman Printing Co., 623 St. Clair Ave., N. E.—printing machinery and equipment for proposed plant, to contain 80,000 sq.ft. of floor space, at Niagara Falls, N. Y.

O., Cleveland—Guide Motor Lamp Co., 2130 West 110th St.—annealing furnace for the manufacture of brass shell work.

O., Columbus—Doddington Co., 451 West Broad St., (mill work), T. A. Jones, Genl. Mgr.—several rip saws, 2 cutoff saws, 3 joiners and general woodworking machinery; also 20 motors from 3 to 25 hp. for new plant on Duerr Rd.

O., Columbus—W. J. Kaiser, 119 East Chestnut St. (sheet metal works)—metal working machinery to enlarge shop.

O., Eldorado—The Bee— 12 x 18 in. job press, 24 in. paper cutter and 8 page folder for power equipment.

O., Kent—The Falls Rivet Co.—machinery and equipment for proposed 1 story addition to plant.

O., Williamsburg—Queen City Shoe Co.—machinery and equipment for proposed shoe factory.

Okla., Newkirk—T. Fry—woodworking machinery, including saw, wood lathe and planer for power equipment.

Pa., Allentown—Allentown Apron Co., 339 Hamilton St., J. Feinberg, proprietor—machinery and equipment for apron factory.

Pa., Ambridge—National Metal Moulding Co.—machinery and equipment for addition to metal moulding products plant.

Pa., Annville—J. H. Lloyd—machinery and equipment for the manufacture of turnbuckles and similar products.

Pa., Bethlehem—Kurtz Furniture Co.—machinery for furniture factory to replace that which was destroyed by fire.

Pa., Blawnox—Blawnox Co. (fabricated steel, etc.)—one 10 ton crane.

Pa., Bradford—E. R. Avery, Box 263—complete well drilling rig and outfit.

Pa., Franklin — Mercer Refining Co.—transmission and conveying machinery for oil refinery.

Pa., Fullerton—Fuller-Lehigh Co.— foundry equipment to replace that which was destroyed by fire.

Pa., Kane—Pennsylvania Silverware Co., F. C. Westfall, Genl. Mgr.—machinery and equipment for proposed addition to plant for the manufacture of metal and silverware specialties.

Pa., Phila.—Chilton Publishing Co., 49th and Market Sts.—stitchers, folders, presses and cutting machines.

Pa., Phila. — Duffy Bros., 3255 North Front St. (meat packers), J. M. Duffy, Purch. Agt.—conveyors, steam cooking vats and refrigerator plant for new factory.

Pa., Phila.—J. M. Melloys Sons Co., 1419 Spring Garden St., (manufacturer of tin ware), G. Melloy, Purch. Agt.—stamping machines, cutters, etc.

Pa., Phila —L. A. Prouty Co., 1029 Ridge Ave. (manufacturer of soda water fixtures) —woodworking machinery, including 16 in. jointer, single spindle shaper, 30 in. band saw, circular saw and boring mill.

Pa., Phila. — J. H. Shriner, 36 North Delaware Ave. (fish dealer)—refrigerating plant and conveyors for new plant on Front St.

Pa., Phila. — United Gas Improvement Co., Broad and Arch Sts.—producers, boilers and conveying systems for loading and unloading at new plant.

Pa., Pittsburgh—Cutler Steel Co., Bowman Bldg. (steel fabricating)—10 ton crane for plant at New Cumberland, W. Va.

Pa., Pittsburgh—Pittsburgh Screw & Bolt Co., Preble Ave. near Island Ave., N. S.—one 3 ton crane and one 5 ton crane.

Pa., Scranton—Gaylord & Butler Pipe Co. (manufacturer of heating equipment), Pine Brook—machinery to replace that which was destroyed by fire.

Pa., Williamsport—H. Baier, 1529 West 4th St.—tinshop equipment.

Pa., Williamsport — Lycoming Motors Corp., foot of Park St.—additional machinery and equipment for plant for the manufacture of automobile motors.

Pa., Williamsport—West Branch Lime Co., Montoursville Rd.—one air compressor, 65 cu. ft. per minute at 80 lb. pressure.

Tenn., Chattanooga — Pipe & Foundry Co., Westside Ave. and 32nd St.—foundry equipment.

Vt., Rutland—P. R. Eaton—additional machinery for lumber mill.

Va., Richmond—W. C. Thurston, 1542 East Cary St. (wagon and automobile body builder)—rip saw.

W. Va., Huntington—Bd. Educ., Library Bldg.—manual training equipment for new schools.

W. Va., Huntington — Huntington Iron Wks., Adams Ave.—traveling crane and fabricating machinery.

W. Va., Huntington—Nightrack Mfg. Co., T. Harvey, Pres.—woodworking machinery and endless belts.

W. Va., Nitro—Charleston Paper Mfg. Co., R. C. Stewart, Secy.—belt conveyor.

W. Va., Wheeling—The Wheeling Steel Corp., Wheeling Steel Bldg.—locomotive crane.

Wis., Antigo—The Langlade Creamery Co.—machinery for proposed bottling plant.

Wis., Ashland—Northland Co-operative Creamery, c/o O. Regelein, R. R. 3—creamery machinery, including power churns, separators, etc.

Wis., Jackson—Jackson Canning Co.—graders for proposed canning factory.

Wis., Mayville—Bd. Educ., A. Droeger, Secy.—machinery and equipment for manual training department of proposed high school.

Wis., Milwaukee—J. L. Austin Mfg. Co., 419 Van Buren St. (manufacturer of grinders, etc.)—shafting, electric motor and later, additional machine tools for plant at Menomonee Falls.

Wis., Milwaukee—The Cedarburg Dairy Co., c/o H. Berns, 1586 Prospect Ave.—dairy and refrigeration machinery, belting and shafting for proposed dairy on 11th St.

Wis., Milwaukee—O. A. Clark Box Co., 1295 33rd St. (manufacturer of paper boxes)—special machinery, including corner cutters, scorers and glueing machines.

Wis., Milwaukee—Harley-Davidson Motor Co., 3732 Chestnut St., (manufacturer of motor cycles), W. Davidson, Purch. Agt. —small crane.

Wis., Milwaukee—Harsh-Chapline Shoe Co., 694 Hanover St.—shoe working machinery for proposed factory.

Wis., Milwaukee — Pfister & Vogel Leather Co., 443 Virginia St.—tanning machinery and shafting for proposed addition to tannery at South Milwaukee.

Wis., Milwaukee—Rose Candy Co., 355 East Water St., C. L. Burg, Purch. Agt.—candy making machinery.

Wis., Milwaukee—Royal Fixture Co., 85 35th St., D. C. Lappin, Purch. Agt.—special machinery and tools for the manufacture of lighting fixtures.

Wis., Oshkosh—Fluor Bros. Constr. Co., 52 State St.—band saw for proposed carpenter shop.

Wis., Platteville—Mound City Mfg. Co.—machinery and small tools for the manufacture of garden tools, etc.

Wis., Port Washington—J. C. Kohl, Grand Ave.—oil storage tanks and pumps for proposed filling station.

Wis., Racine — Lockwood Oil Co., 1421 Racine St., A. L. Flegel, Purch. Agt.—storage tanks and pumps for two filling stations.

Wis., Racine—Western Screw & Specialty Co., Ham Ave.—special machinery for the manufacture of screws and specialties on Clark St.

Wis., Sun Prairie—Standard & Specialty Porcelain Wks., c/o B. J. Chase—machinery and foundry equipment for the manufacture of porcelain products.

Ont., Acton—Thomson Motor Supplies, Ltd., c/o A. Harrison—machinery and equipment for proposed plant for the manufacture of motor supplies.

Ont., Arnprior—Arnprior Creamery, E. McKinny, Purch. Agt.—cold storage plant, boiler and manufacturing equipment.

Ont., London—Silverwoods, Ltd., A. E. Silverwood, Mgr.—equipment for proposed cold storage, ice cream and artificial ice plant at Chatham.

Ont., Newmarket—Russell Bell Flour Mills—equipment for additional mill.

Ont., North Bay—Red Wing Quarry Co., Ltd., H. Stockdale, Genl. Mgr.—stone crushing machinery and equipment.

Ont., Thorold—Ontario Harper Co.—additional paper making equipment.

Ont., Wallaceburg—Sydenham Brick & Tile Co.—drying and conveying machinery.

Que., Quebec—La Compagnie de Construction de Quebec, Limoilu Ward, c/o Standard Steel Construction Co., Welland, Ont.—complete equipment for steel mill.

Metal Working Shops

Ala., Birmingham — The Consolidated Coal Iron Co. awarded the contract for the construction of a 35 x 110 ft. collier, capacity 200 ton per hour. Estimated cost $50,000.

Ark., Stamps—The Louisiana & Arkansas Ry. Co., Texarkana, awarded the contract for the construction of a 1 story, 160 x 288 ft. locomotive repair shop, here. Estimated cost $150,000.

Calif., Corcoran — The Corcoran Union High School District, C. C. Wilson, Clk., will soon award the contract for the construction of a shop building for manual training department. Cost will exceed $5,000.

Calif., Fresno—The W. M. Murphy Motors Co., 1919 Calaveras St., will build a 30 x 75 ft. show room, a 20 x 80 ft. stock room, a 20 x 40 ft. machine shop and a 42 x 88 ft. mechanical shop on Van Ness Ave.

Calif., Oakland—The United States Light & Heat Corp., 5432 East 14th St., awarded the contract for the construction of a manufacturing plant. Estimated cost $50,000. Noted Nov. 16.

Calif., San Francisco—J. Cassaretto, 347 Berry St., will build a 1 story machine shop on Folsom and Dore Sts. Estimated cost $25,000. Noted Nov. 9.

Calif., San Francisco — The city and county of San Francisco, Bd. of Park Comrs., Park Lodge, Golden Gate Park, awarded the contract for the construction of repair shops, etc. Estimated cost $18,-200. Noted Nov. 2.

Conn., Bridgeport—Jenkins Bros., 510 Main St., are having plans prepared for the construction of a factory for the manufacture of valves. Estimated cost $250,000. Lockwood, Green & Co., 101 Park Ave., New York City, Engrs. and Archts.

Conn., New Haven—The Holmes Special Tool Co., 38 Canal St., awarded the contract for the construction of a 1 story, 35 x 65 ft. addition to its factory. Estimated cost $10,000.

Conn., New Haven—A. Krah, 122 Mansfield St., awarded the contract for the construction of a 1 story, 50 x 125 ft. garage and service station on Derby Ave. Estimated cost $40,000.

Ill., Chicago—The Chicago Steel & Wire Co., 10257 Torrence Ave., awarded the contract for the construction of a factory on 103rd St. and Hoyne Ave. Estimated cost $15,000. Noted Nov. 2.

Ill., Chicago—The Goldsmith Bros. Smelting & Refining Co., 29 East Madison St., awarded the contract for the construction of a 1 story, 124 x 173 ft. factory at 5800-5814 Throop St. Estimated cost $55,000. Noted Nov. 2.

Ill., Chicago—C. C. Henderson, Archt., 105 South La Salle St., is receiving bids for the construction of a 3 and 4 story addition to factory for the Golden Rule Cutlery Co., Ogden Ave. and Sheldon St. Estimated cost $20,000.

Ill., Chicago—Huguelet Bros., 908 Gary St., awarded the contract for the construction of a 1 story, 68 x 100 ft. addition to garage. Estimated cost $50,000. Noted Nov. 2.

Kan., Wichita — Crouse Clear Vision Gasoline Pump Wks., 822 East Harry St., plans to build a 2 story, 60 x 70 ft. foundry for the manufacture of castings. Estimated cost $20,000. E. Crouse, Pres. Architect not selected.

Mass., Charlestown (Boston P. O.)—Stanley-Harlow-Hamlin, Inc., Main St., awarded the contract for the construction of a 1 story, 80 x 100 ft. garage, service station and repair shop on Middlesex and Main Sts. Estimated cost $40,000.

Mass., New Bedford—F. W. Greene, 888 Purchase St., awarded the contract for the construction of a 1 story, 80 x 110 ft. garage and service station on Kempton St. Estimated cost $40,000.

Mass., Weymouth — The Brooks-Skinner Co. will build a 2 story, 40 x 130 ft. factory for the manufacture of metal garages. Estimated cost $40,000.

Mich., Detroit — The C. B. Bohn Fdry. Co., 3651 Hart Ave., is having plans prepared for the construction of an addition to its foundry consisting of 1 and 2 story buildings, 37 x 100 ft., 170 x 220 ft., 48 x 210 ft. and 55 x 240 ft., also a 30 x 100 ft. sand bin. Cost will exceed $500,000. C. W. Brandt, 1114 Kresge Bldg., Archt.

Mo., Fulton—N. O. Brown will build a 1 story garage on 4th and Nichols St. Estimated cost $10,000. Architect not announced.

Mo., St. Louis—The Ford Automobile Co., Highland Park, Mich., plans to build a 1 story, 300 x 1,500 ft. assembly plant for automobiles, tractors, etc., on east or west bank of the Mississippi River, here. Estimated cost, including equipment, $5,000,000.

Mo., St. Louis—The Haynes—Langenberg Mfg. Co., 4045-47 Forest Park Blvd., will soon receive bids for the construction of a 3 story, 150 x 200 ft. furnace factory and office building on Euclid Ave near Kings Highway. C. M. Morton, c/o owner, Engr. G. R. Langenberg, 4045 Forest Park Blvd., Archt.

N. Y., Buffalo—The Chevrolet Motor Co., 3044 West Grand Blvd., Detroit, awarded the contract for the construction of a 1 and 2 story, 338 x 900 ft. factory and loading platform on East Delevan Ave., here. Noted Oct. 26.

N. Y., Rochester—M. D. Knowlton, 29 Elizabeth St., manufacturer of paper box machinery, awarded the contract for the construction of a factory at 19 Elizabeth St. Estimated cost $45,000.

O., Mansfield—The Ideal Electric & Mfg. Co., 153 East 5th St., awarded the contract for the construction of a 1 story, 100 x 150 ft. manufacturing plant.

Okla., Tulsa — The Dodge Bros. Motor Co., 716 South Boston St., awarded the contract for the construction of a 2 story garage. Estimated cost $50,000.

Pa., Fullerton—The Fuller-Lehigh Co. plans to rebuild the portion of its core foundry, which was destroyed by fire. Cost between $20,000 and $25,000. Architect not announced.

Pa., New Castle — The Standard Wire Wks. plans to rebuild portion of its wire works, which was destroyed by fire. Estimated cost $30,000. Architect not announced.

Pa., Phila.—Hoffman Henon Co., Archts., Finance Bldg., is receiving bids for the construction of a 1 story, 100 x 120 ft. garage on 37th and Walnut Sts., for W. E. Blair, 5945 Chestnut St. Estimated cost $50,000.

Pa., Pittsburgh—Hubbard & Co., Granite Bldg., awarded the contract for the construction of a 1 story, 80 x 95 ft. addition to shovel factory at 6301 Butler St. Estimated cost $18,000. Noted Oct. 12.

Pa., Pittsburgh—The Metal & Thermite Corp., 1201 Bway, New York City, is receiving bids for the construction of a 2 story, 40 x 100 ft. thermite welding factory on Fayette St., here. Private plans.

Pa., Pittsburgh—The Simmons Co., 824 East Pennsylvania Ave., manufacturer of iron beds, brass wire mattresses and cribs, will receive bids until Dec. 9 for the construction of a 2 story, 179 x 194 ft. warehouse and assembly plant on East River Ave. Estimated cost $150,000. Contractor will submit own plans.

Pa., Scranton—The Gaylord & Butler Pipe Co., Pine Brook, manufacturer of heating equipment, plans to rebuild the portion of its factory, which was destroyed by fire. Estimated cost $40,000.

R. I., Providence—J. T. Avila, 11½ Governor St., plans to build a 1 story garage and repair shop, 50 car capacity, on Hope and East Sts. Estimated cost $40,000. Private plans.

R. I., Providence—W. F. and F. Hussey, 226 Williams St., plan to build a 2 story garage, service station and repair shop, with about 7,200 sq.ft. of floor space. Estimated cost $40,000. Private plans.

Tenn., Memphis—Memphis Machine Wks., 171 Vance Ave., plans to build an addition to its plant.

W. Va., Huntington—The Motor Sales Co., 1611 6th Ave., is receiving bids for the construction of a 2 story, 90 x 100 ft. garage on 6th Ave. and 12th St. Estimated cost $40,000. Meanor & Handloser, Robson-Pritchard Bldg., Archts.

W. Va., Logan—R. E. Matticks awarded the contract for the construction of a 2 story, 52 x 120 ft. garage. Estimated cost $40,000. Noted Sept. 7.

Wis., Appleton—Manthey & Puth, Washington and Morrison Sts., awarded the contract for the construction of a 1 story, 70 x 85 ft. garage on College St. Estimated cost $40,000.

Wis., Green Bay—J. A. Piaskowski, 445 South Jackson St., awarded the contract for the construction of a 1 story, 62 x 165 ft. garage on West Main St. Estimated cost $40,000.

Wis., Menomonie — E. V. Johnson will build a 1 story, 56 x 176 ft. garage and repair shop on Main St. Estimated cost $40,000. Noted Nov. 16.

Wis., Nichols—The All-American Steel Casket Corp., c/o J. A. Burrichter, Church and St. Peters Sts., St. Paul, Minn., awarded the contract for the construction of a 1 story, 60 x 160 ft. factory, here. Estimated cost $30,000.

Wis., Racine—The Racine Mfg. Co., 6th and Mead Sts., manufacturer of automobile bodies and accessories, awarded the contract for the construction of a 2 story, 50 x 120 ft. factory. Estimated cost $50,000.

Wis., Racine—The Western Screw & Specialty Co., Ham Ave., awarded the contract for the construction of a 2 story, 50 x 160 ft. factory for the manufacture of screws and specialties, on Clark St. Estimated cost $40,000.

B. C., Vancouver — The Burrard Iron Wks., 144 Alexander St., awarded the contract for the construction of a machine shop. Estimated cost $10,000.

Ont., Acton—The Thomson Motor Supplies, Ltd., c/o A. Harrison, plans to build a plant for the manufacture of motor supplies. Bylaw will be voted on Dec. 4. Estimated cost $40,000.

Ont., Tilsonburg — The Windsor Tool & Machine Co., Windsor, plans to build a 1 story machine shop, here. Estimated cost $40,000. Architect not selected.

General Manufacturing

Calif., Dinuba—The Dinuba Planing Mill has purchased a site on West Tulare St., and plans to build a mill. Estimated cost, including equipment, $60,000.

Calif., Fresno—The Fresno Consumers' Ice Co., Mono and P Sts., plans to build a 3 story, 90 x 96 ft. addition to ice storage plant.

Calif., North San Diego—The Vitrified Products Co., Spreckels Bldg., San Diego, plans to build a plant for the manufacture of brick, tile and clay pipe near the Santa Fe tracks, here. Estimated cost $250,000, including equipment.

Calif., San Francisco—Richard Hellman, Inc., 602 Jackson Ave., Long Island City, N. Y., manufacturer of mayonnaise dressing, is having plans prepared for the construction of a 5 story factory on a 75 x 245 ft. site on 20th and Harrison Sts., here. Estimated cost, including site, $250,000. A. Toriggino, Mills Bldg., Engr.

Conn., Bridgeport — The Massachusetts Baking Co., Housatonic Ave. and Wells St., awarded the contract for the construction of a 1 and 2 story, 100 x 115 ft. addition to its bakery, including more ovens, a portion for garage and shipping room. Estimated cost $75,000.

Conn., Hartford—The Hartford Courant, 64 State St., is having plans prepared for the construction of a 2 story addition to its newspaper plant. Estimated cost $50,000. I. A. Allen, Jr., Inc., 100 Farmington Ave., Archt.

Conn., Waterbury—The Gulf Refining Co., 21 State St., New York City, awarded the contract for the construction of a 1 story, 40 x 100 ft. plant, a 1 story, 50 x 78 ft. garage, 6 oil tanks and other smaller structures on Riverside St., here. Estimated cost $40,000.

Fla., McIntosh—The McIntosh Utilities Inc. plans to build a cold storage and refrigeration plant. Estimated cost $50,000. N. A. Russell, Treas. Architect not announced.

Ill., Chicago—The Star Wood Turning Co., 2267 Clybourn Ave., is receiving bids for the construction of a 2 story, 40 x 50 ft. addition to factory. Estimated cost $30,000. Koenigsberg & Weisfeld, 5 North La Salle St., Archts.

Pa., Phila.—Ballinger Co., Archts., 12th and Chestnut Sts., is receiving bids for the construction of an 8 story, 60 x 85 ft. printing plant, for the Ketterlinus Lithographic Mfg. Co., 4th and Arch Sts. Estimated cost $250,000.

Pa., Phila.—Cold Blast Feather Co., 169 West Berks St. will soon receive bids for the construction of a 2 story 100 x 158 ft. factory on Tiago and Janney Sts. Estimated cost $70,000. H. R. Stackhouse, 129 South 5th St., Archt.

Pa., Phila.—Duffy Bros., 3255 North Front St., are receiving bids for the construction of a 1 and 2 story, 64 x 68 x 140 x 180 ft. meat packing plant on Front and Venango Sts. Estimated cost $75,000. P. Kuhn Eng. Co., 3058 North 8th St., Engrs.

Pa., Pittsburgh—The Dusenberry Baking Co., 2138 Tustin St., is having plans prepared for the construction of a 3 story, 50 x 100 ft. bakery at 3201-15 Forbes St. Estimated cost $100,000. Rubin & Veshancey. Union Arcade, Archts.

S. C., Greenville—The Mills Mill awarded the contract for the construction of a 4 story, 50 x 100 ft. addition to its cotton mill. Estimated cost $35,000.

Tenn., Memphis—The Crown Rice Mill & Feed Co. is building a 4 story rice mill on Nichols St. and Union Belt R.R. Estimated cost $75,000.

Tenn., Nashville—The Baptist Sunday School Bd., 8th Ave., awarded the contract for the construction of a 2 story printing and publishing plant on 10th and Bayne Aves. Estimated cost $158,000.

Tenn., Nashville—The Warren Paint & Color Co., Wedgewood Ave., will build a 2 story paint factory, including oil tanks Estimated cost $10,000.

Va., Richmond—The Wheeling Corrugating Co., 801 McDonough St., plans to build a 2 story addition to its factory for the manufacture of corrugated products. Estimated cost $17,000. Architect not announced.

Wash., Chelan—The Great Northern Ry. Co., Havermale Island, Spokane, is having plans prepared for the construction of an ice manufacturing and cold storage plant, here. Cost between $400,000 and $500,000. W. A. Wells, 601 Hyde Bldg., Spokane., Engr. and Archt.

W. Va., Huntington—The Nightrack Mfg. Co. is receiving bids for the construction of a 2 story, 40 x 120 ft. woodworking factory. Estimated cost $25,000. T. Harvey, Pres. W. F. Diehl, R. & P. Bldg., Archt.

W. Va., Parkersburg—The Ideal Corrugated Box Co. awarded the contract for the construction of a 2 story, 72 x 150 ft. addition to its box factory on Jeannette St. Estimated cost $25,000.

Wis., Crandon—The Vulcan Last Co. will build a 2 story, 60 x 120 ft. shoe factory. Noted Oct. 5.

Wis., Fond du Lac—B. E. Mehner, Archt., Main St., is receiving bids for the construction of a 3 story, 42 x 180 ft. factory and warehouse on Military St., for the Combination Door & Screen Co., 180 Ruggles St. Estimated cost $50,000.

Wis., Milwaukee—C. J. Keller & Son, Archts., 432 Bway., are receiving bids for he construction of a 2 story, 50 x 60 ft. addition to factory for the Federal Rug Cleaning Co., 914 Winnebago St. Estimated cost $20,000.

Wis., Rhinelander—The Northern Grain Co. will build a 1 story, 50 x 120 ft. feed mill, etc. Estimated cost $40,000. O. C. Nelson, Mgr. Private plans.

Alta., Calgary—The Imperial Oil Co. Ltd., 56 Church St., Toronto, Ont., awarded the contract for the construction of an oil refinery, here. Estimated cost $2,500,000.

B. C., Vancouver—The False Creek Lumber Co., 6th Ave., W., is having plans prepared for the construction of a lumber mill. Estimated cost $150,000. Private plans.

Ont., Elmira — The Elmira Co-operative Creamery awarded the contract for the construction of a 2 story, 40 x 50 ft. addition to its creamery. Estimated cost $18,000.

Ont., Paris—Penmans Ltd., manufacturer of woolen underwear, awarded the contract for the construction of a 3 story addition to plant No. 2 and a 1 story addition to plant No. 1. Estimated cost $100,000. Noted Oct. 12.

Ont., Welland—The St. Thomas Packing Co., St. Thomas, Ont., awarded the contract for the construction of a cold storage plant, here. Estimated cost $100,000. Noted June 29.

Que., Valleyfield—The Montreal Cottons, Ltd., are building a 4 story, 102 x 120 ft. waste plant.

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Repair Work in a Tennessee Railroad Shop

Arc Welding—Driving Box Work—Machining Shoes and Wedges—Utilizing Old Asbestos Insulation—Inserting New Pieces in Broken Frames

BY S. ASHTON HAND
Associate Editor, *American Machinist*

ARC WELDING both for repairing broken parts and building up worn surfaces is a great boon to the railroad shop. Some examples of work done by the electric arc at the Coster shops of the Southern Railway System, Knoxville, Tenn., are shown in Figs. 1, 2 and 3. The slipper-type crosshead, Fig. 1, was cracked along the line *A* so the metal was cut out between the lines *B* and *C* and new metal fused or welded in by the electric torch, rendering the crosshead as serviceable as if a whole new casting had been made.

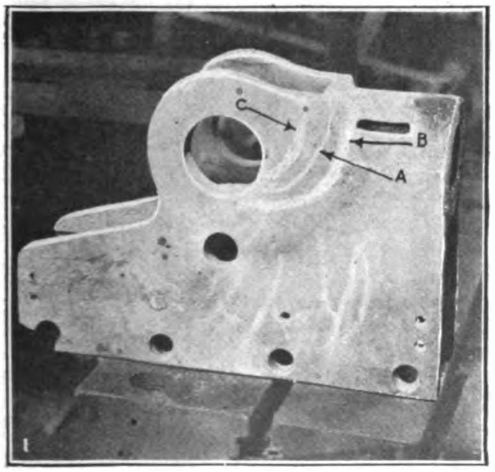
The cylinder head at the steam end of an air pump, Fig. 2, needed building up in the hole *A* and on the face of the boss to provide metal for truing while undergoing repairs. As building up with iron leaves a surface difficult to machine satisfactorily, the building up was done with brass. Another place where brass was used was on the outside of the piston shown in Fig. 3. Nearly all the wear on a piston is at the bottom where it bears on the lower part of the cylinder wall. When such wear reduces the piston so that the depth of the groove is insufficient to properly support the rings, the piston will have to be scrapped unless some method is at hand to restore metal in place of that worn away.

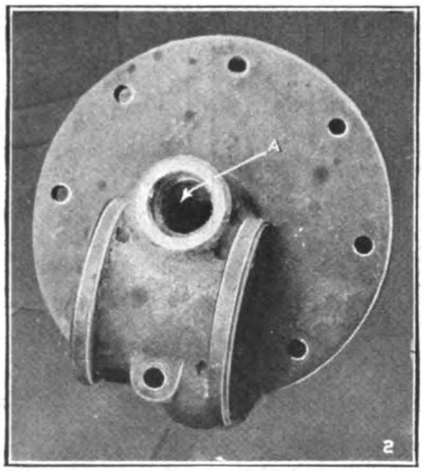
In the piston referred to, brass has been fused on that part of the periphery next to the first groove, and between the points *A* and *B*. The job has only been started and the other parts of the periphery between *A* and *B* will be likewise built up. After enough metal has been put on, the piston will be trued up in the lathe and the sides of the grooves faced. It has been the experience in this shop that pistons so repaired run longer between repairs than do new ones and that, as brass and iron make excellent bearing surfaces, there is less wear on the lower walls of the cylinders.

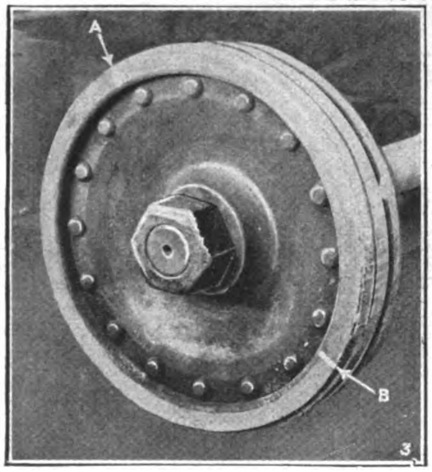
The repair of driving boxes constitutes a large item in the work of railroad shops and boxes for the heavier types of engines are so large as to tax the capacity of some of the machines used for certain parts of the work. One of the driving boxes of a Santa Fé type engine is shown undergoing the boring operation in Fig. 4. As this box carries a crown brass 22 in. long, some idea may be had of its size and the difficulty of handling it on machines installed before this type of engine was in use. It was stated above that the crown brass for this box was 22 in. long. Originally, the crown brass was that length, but the Southern System has found that brasses of such length wear bell mouthed on the ends next to the driver hubs, leaving about 14 in. for actual bearing on the axle. As the other 8 in. does no good, it was decided, when making repairs, to put in brasses only 14 in. in length, thus saving a considerable amount of costly material.

A few driving boxes of the ordinary type in the shop for repairs are shown in Fig. 5. Some must be replaned where the shoes and wedges fit, others must have new hub liners put on, and nearly all must be fitted with new crown brasses. In pressing crown brasses in or out of the boxes, the hydraulic press, Fig. 6, is used. Here all the boxes belonging to one engine are put on the truck shown in the illustration. This truck passes freely through the opening between the ram and anvil of the press, so that the boxes are brought consecutively into position by merely pushing the truck along the rails. This method of handling keeps the boxes for each engine by themselves.

Machining crown brasses to fit driving boxes may be done in several ways, such as shaping, slotting, or turning on the boring mill or lathe. Figure 7 shows the







FIGS. 1 TO 3—REPAIRS MADE BY ELECTRIC WELDING

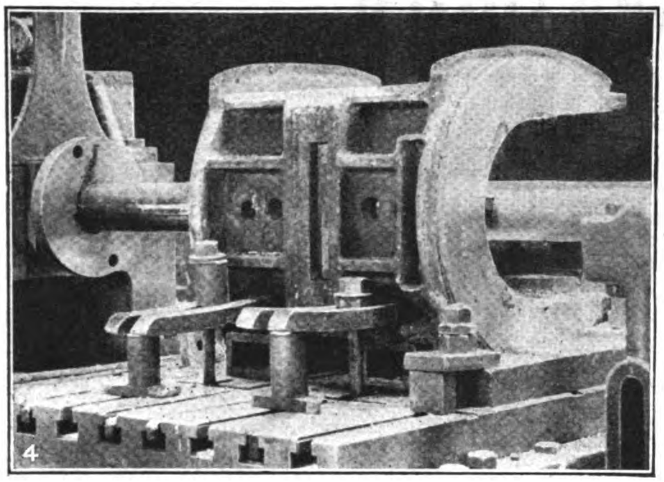


FIG. 4—BORING A SANTA FÉ DRIVING BOX

FIG. 5—DRIVING BOXES TO BE REPAIRED

operation on the lathe where the brass is mounted on a special mandrel and confined between collars at each end. Cup pointed setscrews in the collars bite into the ends of the brass and hold it securely. In planing driving boxes, they are strung out on the planer table, each box being held down by its individual pair of clamps, as shown in Fig. 8. End stops, to prevent shifting under the pressure of the cut, are, of course, set in place.

Shoes and wedges are also strung out on the planer table, shoes on one side and wedges on the other, as shown in Fig. 9. Both planer heads are in use and carry special tools, the one at *A* planing both the inside edges of the shoe simultaneously. The straddle tool for planing the outside edges, to be seen on top of the shoes at *B*, is a forging fitted with clamps for holding toolbits at *C* and *D*. To the right of the straddle tool at *E* is one of the clamps used between the ends of the shoes to hold them in place during the planing operation.

The tools and clamps described are used alike on both shoes and wedges. Shoes and wedges for engines of the Santa Fé type are generally planed singly as there

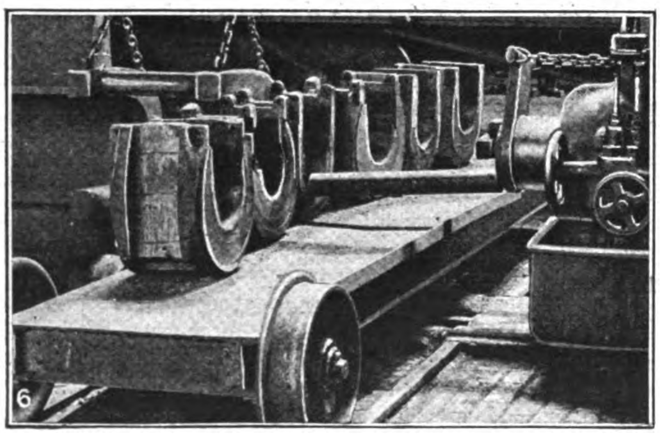


FIG. 6—PRESSING OUT CROWN BRASSES

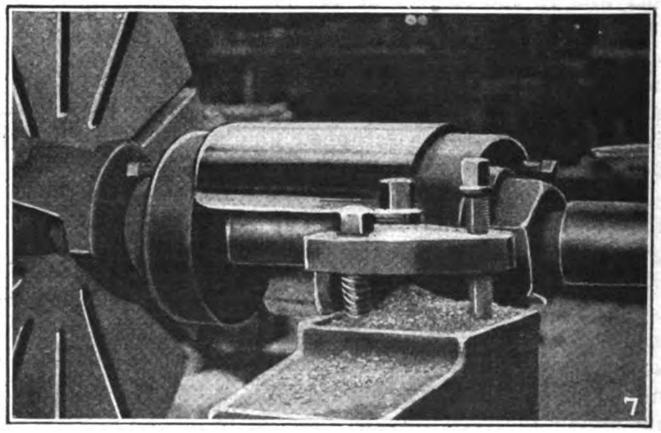
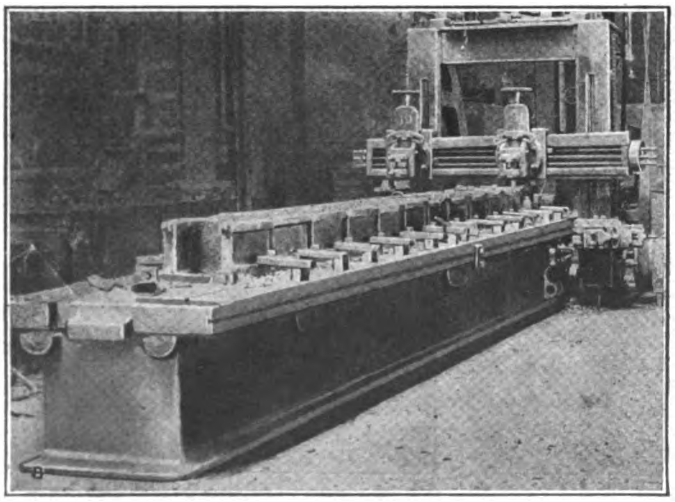


FIG. 7—TURNING A CROWN BRASS



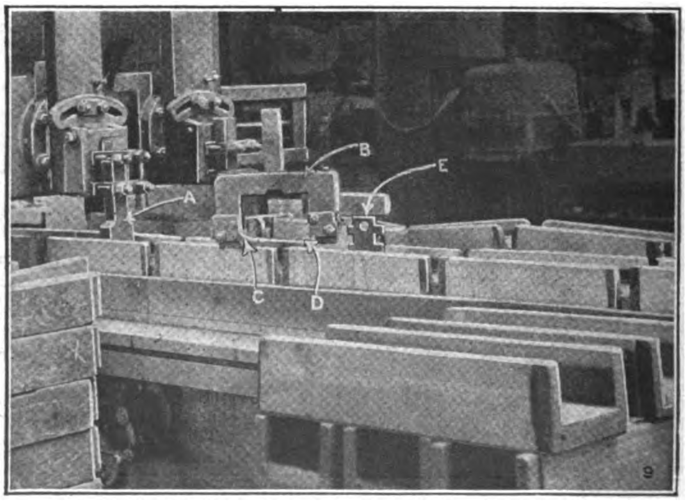
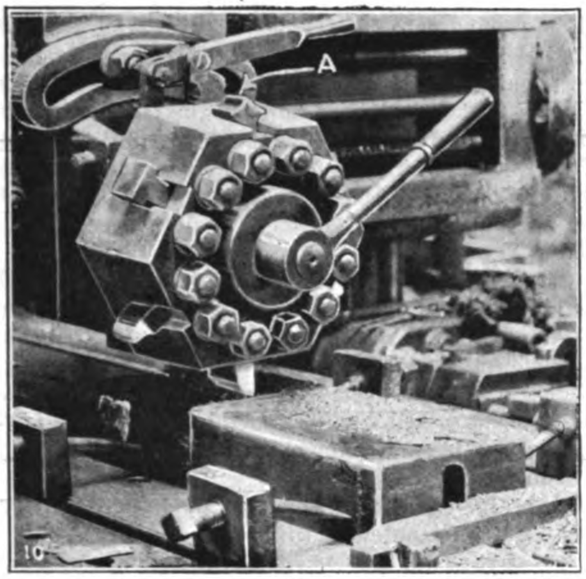


FIG. 8—PLANING DRIVING BOXES. FIG. 9—PLANING SHOES AND WEDGES



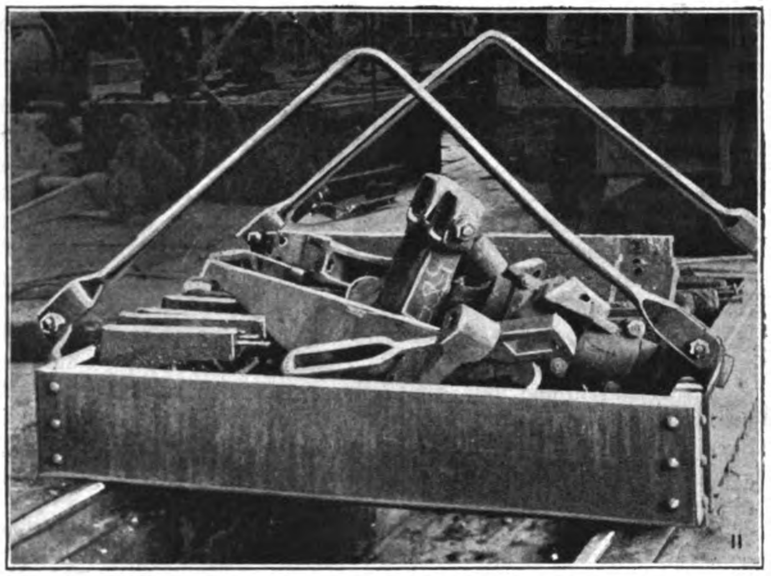


FIG. 10—TURRET MOUNTED ON PLANER HEAD. FIG. 11—BOX FOR TRANSPORTING SMALL PARTS

are not enough of them to be planed at any one time to warrant fitting up for stringing them out. Even where this is done, it would only apply to work on the outside as they are closed at one end which would prevent the inside tool from passing through. Fig. 10 shows the

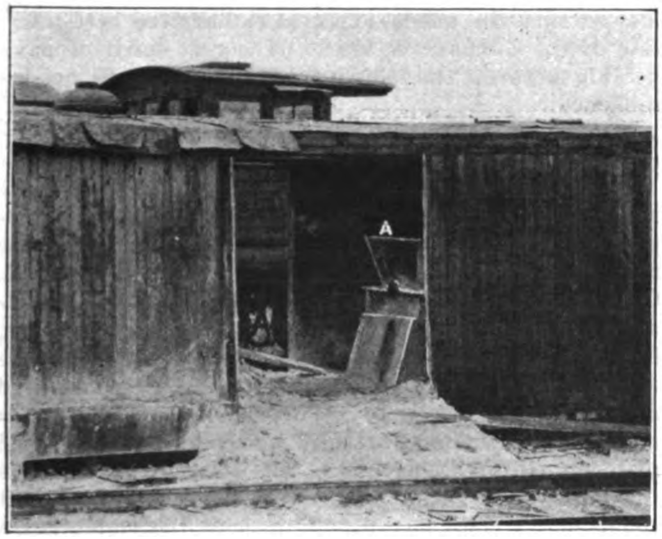


FIG. 12—MILL FOR GRINDING ASBESTOS

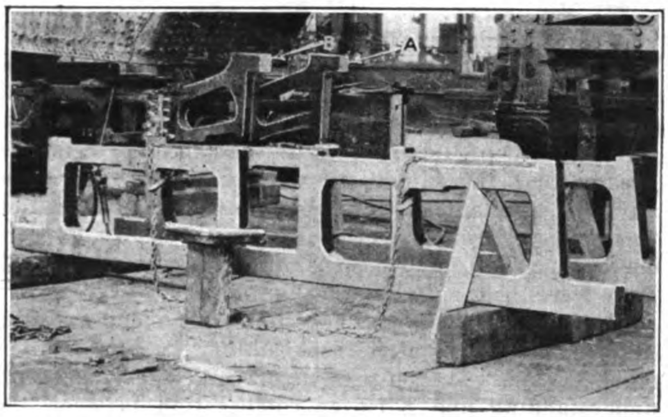


FIG. 13—NEW PARTS OF FRAMES

planing of a Santa Fé type shoe on a planer provided with a turret in which all the necessary tools are held. At the top at *A* is the combined right and left hand tool for forming the rounded corners on each side of the shoe.

When locomotives are stripped for repairs, all smaller parts are put in shallow boxes or trays permanently equipped with slings so as to be readily handled by the crane. One of these boxes is shown in Fig. 11. By

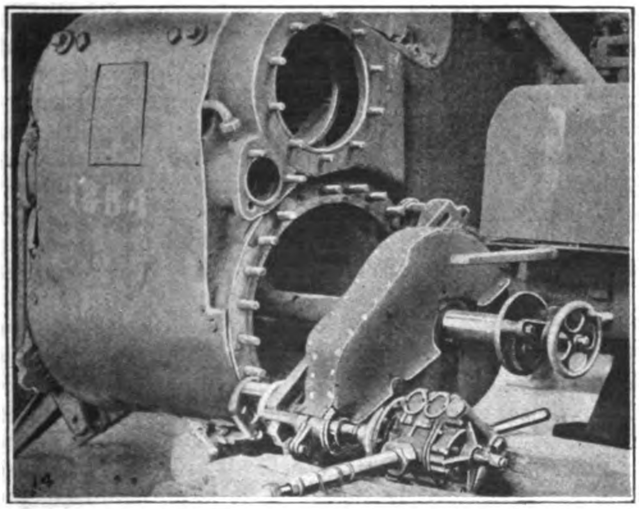


FIG. 14—RE-BORING A CYLINDER

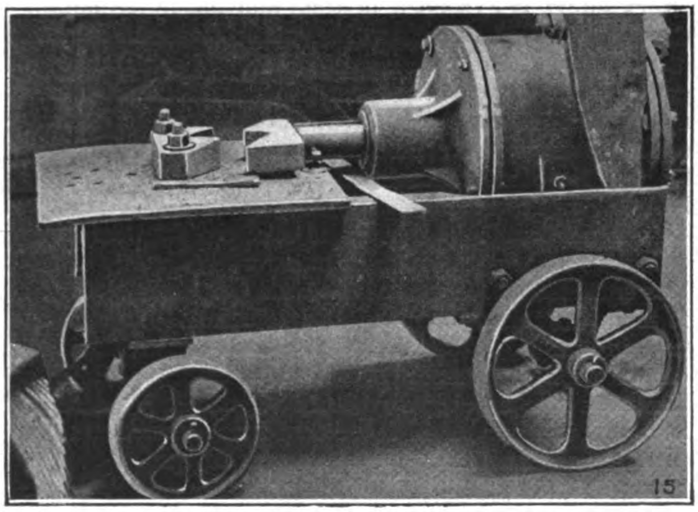


FIG. 15—A PORTABLE BULLDOZER

this method the smaller parts of an engine can be transported to any part of the shop and kept by themselves.

In stripping the jacket from the boiler, many of the asbestos blocks or slabs used for insulation are more or less damaged so as to be unfit for use. In some shops these damaged blocks are scrapped, but here a grinding mill has been installed in an old freight car as at *A*, Fig. 12, where the blocks are ground up. The pulverized material is made into plaster and used for filling in between blocks and covering irregular surfaces when reinsulating the boiler and answers the purpose as well as new plaster.

Cracked frames are generally repaired by welding, using the thermit process. It sometimes happens, however, that frames are so badly damaged that a considerable part of one or both have to be cut out and new parts welded in place.

New parts for a pair of frames are shown in Fig. 13 and will be welded onto the frames of the engine blocked up behind them. The rear ends of the damaged frames have been cut off at *A* and *B* and, when the new parts are welded on, the welds will be over the centers of the jaw openings. Before the advent of thermit welding, these frames would have been removed and taken to the blacksmith shop where the damaged parts would be cut out and the new parts welded in their places in the old fashioned way.

The universal use of compressed air has simplified many of the repair jobs. The ease by which power can be supplied to portable tools such as the cylinder boring machine is shown in Fig. 14. The blacksmith shop too has been the gainer by the introduction of compressed air, as portable tools, such as the bulldozer or bender, shown in Fig. 15, can be used at any fire that may be convenient.

It may be mentioned in passing that the Southern valve gear was originated in this shop.

Employment and Labor Turnover

A careful selection of employees and the development of a better understanding and closer co-operation betwen the employment department and department heads are among the big employment problems of today. Before the fall of 1920, when the demand for help was greater than the supply, we welcomed with open arms anybody who applied for a position. Scant attention was paid to careful selection. It was vital to fill vacancies rather than to choose the applicant whose qualifications were most suitable for the job.

The time has arrived when the employment manager must shoulder the entire responsibility for selecting the right person. The outgrowth of this will be a better understanding and a closer co-operation between the employment department and the department heads, as well as the building up of a better personnel. Until he accepts this responsibility the employment manager can not command the confidence of the operating man on the job.

Turnover as a Health Indicator

A high labor turnover indicates an industrial disease. A very low labor turnover may similarly indicate an unhealthy condition due to failure to eliminate the unfit. Turnover is an index of the health of the company from the point of view of good employer-employee relations. Every effort is expended in time and money to obtain the good will of customers and when obtained to hold it. No organization can be successful without this policy. Why should it not be just as important, if not more so, to obtain the good will of employees? Someone has every aptly called labor turnover the "yardstick" by which we may measure the mutual understanding between employer and employee.

It is impossible to figure the cost of labor turnover except in a very general sort of way. Too many variables enter into it. Some of the costs can be figured, but it is impossible for example to determine the cost of training an employee. Some are more intelligent than others with the result that it takes less time and is therefore less expensive to train them. It is possible, however, to show an employer that turnover reduces his profits, and frequently it is easy to do so.

Abstract of a committee report presented at the first annual convention of the National Personnel Association, Pittsburgh, Pa., Nov. 8-10, 1922.

The importance of a group of employees who have had long service with a company can not be overestimated. No matter how well the employee is instructed in company policy, he does not really understand the policies of that company until he has learned them through experience. The employee who sticks is the real backbone of the company. The one who stays only a short time can not be expected to have the best interests of the company at heart. The real spirit of partnership between the employer and employee is not established.

Cost of Training

High turnover means high cost of training, with the result that training activities for those already employed must necessarily be curtailed on account of the time and effort expended in training new employees. Organizations which have no regular training departments may feel that they are under no training expense, but they are selling themselves a "gold brick," for there is no line of endeavor where training of some kind or other is not required. The expense of training a machinist, for instance, results from high cost of spoiled material, injured machines, and loss of time. As the purpose of all labor turnover figures is to correct conditions which cause people to leave the employ of a company, it is necessary to obtain the true reason for leaving. These, at best, are difficult to obtain. Following the line of least resistance, an employee will say that he is moving out of town, or is going to remain at home, rather than to state frankly that his real reason for leaving is bad working conditions, improper supervision, etc. Many others will leave without giving the real reason or without any notice whatever. If this happens to any great extent it means that the employment department is not functioning properly. This difficulty can be overcome to some extent by arranging that the payroll department can not give an employee his final pay without the authorization of the employment department. This plan allows some representative of the employment department to interview all people who leave, and thus cuts down to a minimum the number of those who give no cause whatever for leaving. In interviewing an employee who is leaving, it is necessary to approach him sympathetically if the real cause for his exit is to be learned. If he is antagonized, the investigator has had his trouble for nothing.

Industrial Cost Accounting for Executives

Third Article Deals with the Elements of Manufacturing Costs—Direct Material, Labor and Charges—Burden—Three Groups of Manufacturing Functions

By PAUL M. ATKINS

BEFORE WE can start in making records and setting up accounts, we must have some idea of what we are going to account for and record. In the case of cost accounting, that means we must have some comprehension of what the elements of manufacturing costs really are. Perhaps the reader may think to himself—Why that's easy; material, labor and overhead—everyone who knows anything at all about manufacturing records is quite familiar with that. The rub comes, however, when you try to explain just what you mean by material, labor and overhead from the cost accounting point of view. The general statement sounds easy and is fundamentally correct but, as soon as the elements are analyzed a little, certain difficulties are met with and it becomes evident that the whole question is not quite so simple as it appears at first glance.

Let us take up the various elements in order and study them a little to see what they involve. No product can be turned out without material, so it is quite appropriate to start with that cost factor. At first, it seems as though it should be quite simple to determine the cost of the material which goes into the product. If an adequate system of production control is established, no material should be issued to the factory without a written order for it. In the joobing or intermittent type of industry, written requisitions or issues should be prepared on which may be recorded the quantity of material sent out.

In the case of a continuous process plant, a standing order to issue so much of certain kinds of material each day and a notation of the quantity sent out should be sufficient record. In either case, it appears as though it should not be difficult to ascertain the cost of the "direct" material, as the material going into the product is called. So many pounds of flour, of bar steel, so many yards of sheeting, such a number of screws, bolts, castings, parts, etc., are issued for use in making the product. With the quantity known and the price fixed or findable, it should not be hard to determine the cost of direct material.

Some Materials Cannot Be Measured

It sometimes happens that there are certain practical difficulties in the way of keeping track of all the many details, difficulties which are due to the number of records which must be handled when large quantities and a wide variety of materials are issued. There are other kinds of material, however, which enter directly into the makeup of the product and yet which cannot be measured against it.

Let us take as an example the enamel which goes on the box covers of an electric switch. The enamel is certainly direct material because it forms a part of the saleable product. But how much of it actually goes on any one box cover or on any order for box covers? The engineering department or the laboratory can quite possibly tell how much *should* go on, but the cost records must show not what ought to happen but what has actually happened. The box covers are first dipped in the tank of enamel and come up dripping. They are hung over a board to catch this drip until the enamel ceases to run off and are then pushed into an oven to be baked.

It is practically impossible to measure and record the amount of this enamel against the order and so from the cost-accounting point of view it cannot be treated as direct material, although essentially that is what it is. It must, therefore, be handled in some other way. In defining direct material costs, it will be necessary to say that they are such costs of material going into and forming a part of the product as can be ascertained with a reasonable degree of accuracy at a reasonable cost.

Direct Labor That Cannot Be Charged

When we consider the matter of labor we find that a similar condition exists. In most cases it is possible to measure and record the value of the labor which is engaged directly in turning the material into the product. Whether that labor is paid by a piece rate or by some system of wage payment in which the time taken is the prime element in the measurement of the charge, is immaterial. We can measure the output or the time taken for work on a particular product or order and, knowing the rate of payment, we can calculate the direct labor cost for making the product.

On the other hand, just as in the case of material, we will find there are occasions when it is not practical to measure the time taken and so ascertain the direct labor cost. A battery of automatic lathes or screw machines is operated by one man. He goes from one to another, spends a little time adjusting one, starts some material in another, sits and looks at the whole group a few moments, doing nothing but necessarily there to take care of any need which may arise.

If all the machines are working on one order, his time might, of course, be charged to that order, but if they are working on different orders, how is his time going to be split up among them? He changes from one to another so frequently that he would spend almost as much time recording as working if he tried to allocate each moment of his time. It certainly would not pay to keep some one there to record the changes for him, and hence we find that, although he is working directly on the product, his wages cannot be treated as a direct labor cost. The expense must be handled in some other way, just as in the case of the enamel above described. Our definition of direct labor cost from the cost accounting point is that it is the cost of that labor engaged in working directly on the finished product which can be measured with reasonable accuracy at a reasonable cost.

Here we have then direct material costs and direct labor costs and are apparently ready for an investigation of what is commonly called "overhead" or "burden." Before going on to this topic, however, we must pause for a moment to consider an element of cost

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For the author's forthcoming book.

which has not yet been mentioned, which appears only infrequently, but which we cannot, nevertheless, leave out. It belongs at this point in our discussion for it is essentially one of the direct costs.

Perhaps the best way to make clear what the element is, which we may call "direct charges" is to take an example. A machine shop turning out machines to order may have some part which is just too large for the equipment which it has to handle. The bed of the machine may be a bit too big to be planed on its planer and so the company sends it out to some nearby concern to have the work done for them. When the work is completed, the first company will receive a bill for it. It is evident that this bill is not for material, neither is it for labor alone, but is rather for the service rendered which is made not only of the labor but also of the cost of operating the machine on which the work was done and the profit which the second company makes on the job. At the same time from the point of view of the first company, the bill is not an element of expense, as will be obvious after the next few following paragraphs have been read, but is properly a direct charge against the order for the production of the machine on which the bed is to be used.

Hence we see that our study of the elements of manufacturing costs has revealed so far that there are ordinarily two and some times three direct costs:

(a) Direct material,
(b) Direct labor,
(c) Direct charges.

It has also shown us that the inclusive idea of direct material and direct labor needs to be modified when approached from the cost-accounting viewpoint in order to limit them to such materials and such labor as can be satisfactorily measured against the order for the product.

We are now ready to turn our attention to the question of overhead or burden as it is called by preference in these articles and try to see what it is and how it plays a part in making up the cost of the product. To my mind, burden is simply the cost of the operation of the business as a whole. A certain portion of this cost which measures the value of the services rendered by the business in the manufacture of the goods should be called earned burden and is chargeable to the orders for making the product as a proper part of the cost of production.

The other portion is a load which the business as a whole must carry and may be called "unearned burden" because it is a load which represents either excessive cost of operation or unused plant capacity or both. It is not chargeable to the product but directly to profit and loss. Space will not permit a thorough discussion of this subject here, so I must ask my readers to be patient until a later article—"Burden Earned and Unearned"—is reached. In that article the topic is vigorously investigated.

The task now before us is to see what the sub-elements of burden are. It has been stated that the burden was the total cost of the operation of the business, or, in other words, is the total of the expenses, which may be conveniently defined as the cost of carrying on the various departments of the business into which its functions are subdivided.

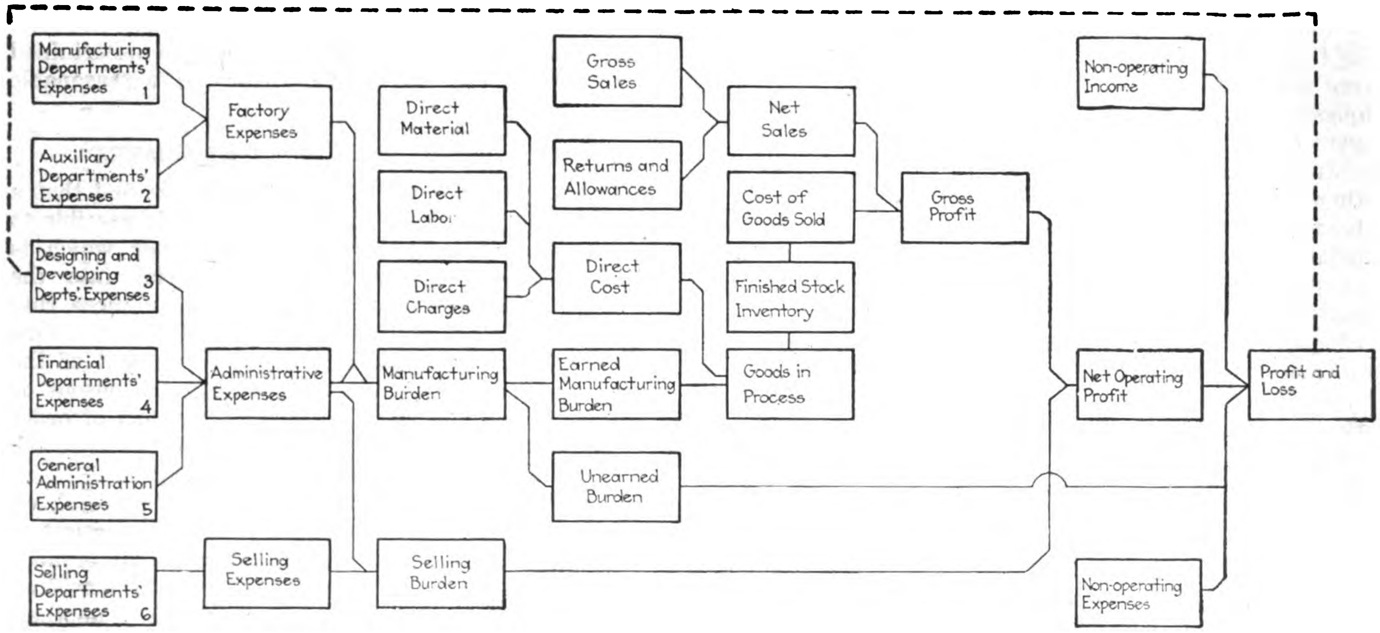

FIG. 1—A TYPICAL COST ACCOUNTING SYSTEM

The first step to be taken in studying expenses and burden, as the two phases of overhead are called, is to investigate the subdivision of the business into its functions or departments. Not more than a word or two can be said about this topic, but a later article will be devoted entirely to it. A few general suggestions, however, are necessary here. A business is nothing more nor less than a collection, sometimes a systematic, well organized collection and sometimes a heterogeneous collection of activities called functions. These are grouped into what we call departments and should be so put together as to promote harmonious co-operation in what may be termed an organization.

It is perfectly evident that the activities are going to vary greatly from industry to industry and even from company to company within an industry. Hence they cannot be discussed in detail unless a particular case is in hand. A few general points can be made, however, and these will apply to almost all manufacturing concerns no matter what their product may be.

There is hardly any manufacturing business in which the functions are not properly divided into three prin-

cipal groups. There are those which are principally concerned with the production of the finished goods; those which are occupied with selling the goods; and finally, those functions whose part is to guide, direct, supervise, and aid both selling and production. The first group may well be called the "manufacturing" functions; the second group, the "selling" functions; and the third group, the "administrative" functions.

Whether the product is steel rails or flour, cotton cloth or machinery or any other manufactured product, it must be produced, sold, and the business as a whole, administered. The three groups ordinarily should be divided in turn into departments which are the units most commonly employed as the basis for the organization and operation of the business. Of course, the number and kind of departments will vary according to the business. For our present purpose, however, it does not make any difference what they are.

Importance of Groups in Cost Accounting

It is of considerable importance that the distribution between the three groups be kept clearly in mind. The expenses of the business, it will be remembered, should be divided up according to the various departments for whose benefit they are incurred. Hence they will fall quite naturally under the three headings given above. It should be perfectly clear that all of the manufacturing expenses go to help make up the manufacturing burden but that none of them form any part of the cost of selling.

In the same way, the selling expenses are in no sense a part of the manufacturing burden but help only to make up the cost of selling. The expenses of administration are properly divided between the two since the administrative departments exist expressly for the benefit of the two other groups of functions.

Theoretically, then, the total burden of the business is divided into two parts, one of which represents the cost of operations involved in making the goods and the other, the cost of selling them. The manufacturing burden, as was pointed out, is properly divided into earned and unearned burden. Practically, there are certain difficulties involved in applying these theories to actual cases, though it is surprising how closely the theory can be followed in practice if correct methods are used. All such details as are commonly called 'indirect" or "non-productive" material, labor and expense are all included under the head of expenses together with insurance, depreciation and such items.

Elements of Manufacturing Costs

The elements which go to make up the cost of producing any goods are therefore:

(A) Direct costs
   1. Direct material
   2. Direct labor
   3. Direct charges

(B) Burden (Earned)
   1. Depreciation and other fixed charges
   2. Indirect labor
   3. Indirect material
   4. Other expenses

From this point on the course of the costs should be easily grasped from a study of the accompanying charts which show how the cost system interlocks with the general accounting system to form one comprehensive and consistent set of accounts and records. In the next article will be given a summary of the various accounts and journals which are necessary for a satisfactory recording of the various cost elements.

Explanation of Figure 1

Definition.—Expense consists of the expenditures necessary for the operation and maintenance of the various departments and includes such charges as taxes, insurance, depreciation and maintenance of all property occupied or used by the departments and a fair share of such charges for property used by several or all in common, wages and salaries of those whose time cannot be readily allocated to some production or improvement order; material used in the operation of the department, such as stationery, oil, waste, coal, etc.; outside services such as telephone, telegraph, water rates, etc.—in short, all expenditures incurred by the several departments which are needed to enable them to give the service they are expected to render. The kinds of expenses involved vary according to the departments.

1. *Manufacturing Department's Expense.* Made up of the expense incurred directly in the operation of the departments engaged directly in the manufacture of the product by changing the form or condition of the raw material.

2. *Auxiliary Department's Expense.* Made up of the expense of such departments as Purchasing, Cost, Manufacturing Standards, Finished Stock and Shipping, Heat, Light, Power, Inspection, Tool Cribs, Maintenance, Planning, Receiving, Stores, Safety and Sanitation, Training, Tool Manufacturing, Internal Transportation, Watchman and Pattern — departments whose services are rendered directly and primarily to the manufacturing departments and only incidentally to any others.

3. *Designing and Developing Department's Expense.* Made up of the expense of such departments as Blue Print and Photographs, Chemical Laboratory, Drafting, Engineering, Filing (Blue Prints and Drawings), Physical Laboratory, Experimental—departments whose chief service is that of designing and developing new products.

4. *Financial Department's Expense.* Made up of the expense of such departments as Accounting, Billing, Credits and Collections, Insurance (Property), Paymaster and Cashier—departments whose chief service is the handling and recording of financial transactions.

5. *General Administration Department's Expense.* Made up of the expense of such departments as Executive, Filing (General Office), Legal, Stenographic, Traffic—departments whose services are rendered to the business as a whole rather than to any one particular section of it.

6. *Selling Department's Expense.* Made up of the expense of such departments as Publicity, Sales, Branch Offices, Customers' Service—departments whose services consist of selling the goods of the concern and of keeping them sold.

Repairing an Engine Under Difficulties

By Hiram Hicks

Some years ago the writer was called upon to make repairs on a steam engine that furnished power for a small manufacturing establishment in a remote village.

The engine had been built by one of the old-time "backwoods" machinists from ideas and patterns of his own, and was like nothing else that ever existed. It was of the vertical type with the crankshaft at the apex of a pair of A-frames; it had two cylinders connected in the usual way to crank disks at opposite ends of the shaft, and it developed probably from 15 to 20 horsepower. The two sides of the engine were quite independent and either was capable of keeping the shop wheels turning if care was taken to regulate the power requirements to avoid "peak" loads.

There was nothing the matter with the engine except general debility; having been worn by long continued service until it was blowing away more steam than it used and making more noise than a freight train. The machine shop where it was built had long been out of business and no other was available. The shop must not be closed and there was no other power.

The only machine-tool equipment was an engine lathe of about 18-in. swing, built by the same machinist that had built the engine, and located in the attic of the shop. There was plenty of junk—the accumulated odds and ends of thirty years—from which to draw raw material, and I was fortunate enough to find in the pile all that was necessary to "make" new parts for all that had to be replaced except the pin brasses, castings for which I obtained by express from a far-away city brass foundry.

Having everything in readiness at 12 o'clock one day, one side of the engine was disconnected, the crank disk drawn off, steam and exhaust outlets plugged and a pair of improvised half-boxes fitted to that end of the shaft—all in the short space of one hour. At 1 o'clock the remaining side was started up, and it clattered gaily away for nearly two weeks while its mate was being rebuilt.

Reboring the cylinder was the first job. The casting was blocked up on the carriage of the lathe from which the cross-slide had been temporarily removed, a boring bar was placed on centers, the cylinder lined up by tramming, and two cuts were run through the bore. This was a good afternoon's work.

How the Lathe Was Rigged

Without disturbing the setting of the job the compound slide of the lathe was bolted to an angle plate that had previously been prepared to be bolted to the back of the lathe bed, and the lathe had become a shaper with a vertical slide but no cross adjustment. A splining tool of the kind commonly used for cutting keyways in the bores of wheels, gears, etc., adapted itself very nicely to the job of resurfacing the valve seat. No change was necessary in this tool except in the manner of using it; the "top rake" had become the "clearance" and the "clearance" the "top rake."

The traversing movement, equivalent to the movement of a shaper ram, was supplied by running the lathe carriage back and forth along the shears by means of the handwheel, elbow grease being the fuel consumed to supply the power. As the "shaper" had no cross movement (the casting being still bolted to the wings of the carriage) tool adjustment for successive cuts was made by putting sheet metal shims of the required thickness under the tool.

The next shaper job was the replaning of the crosshead guides. These, fortunately, were separate pieces bolted to the face of the A-frames and, being of generous proportions, needed little more than resurfacing. The crosshead was fitted with bronze shoes so that the amount of material removed from the guide (and also from the shoe) was compensated for by putting sheet metal shims of the proper thickness between the shoes and the crosshead.

The making of new pistons from chunks of iron several sizes too large, of piston rings, rods, wristpins and crankpins, etc., as well as the making of new eccentrics and reboring the straps to fit, was ordinary lathe work. The machining of the new pin brasses was, however, beyond the limitations of my "shaper" and the lathe had to become a milling machine. Several milling cutters were accordingly made, with tapered shanks to fit the spindle hole, and fluted by laying a suitable cutting tool on its side in the toolpost and again applying hand power to traverse the carriage back and forth.

To space the teeth somewhere near evenly a locking pin was rigged up to enter the tooth spaces of the main spindle gear. (I would not advise the use of this sort of a plate for accurate indexing.)

A milling machine requires movement in three planes (so, also, does a shaper for that matter) besides the rotative one of the cutter, and here the old backwoods machinist had unwittingly come to my aid when he built that lathe, for he had supplied an extra toolblock to go in place of the compound slide that could be adjusted vertically. By tapping two entirely unpremeditated holes in the front of that toolblock and making a small angle plate I was able to mount the brasses below the cutter in position to take advantage of all three adjustments.

Milling the channels in those brasses to fit the connecting-rod straps was child's play compared to the labor of getting ready to do it. With the milled brasses fitted to the straps and secured with the regular keys and a dummy rod end, the lathe once more became a lathe for the boring and facing operations.

One piece that puzzled me for quite a while was the valve, a plain D-slide, the surface of which constituted by far the largest part of it. It was so small and of such peculiar shape, besides having no place to get a strap on it without covering the surface to be machined, that I could not invent a way to hold it. I finally compromised by filing it flat and scraping it to match the valve seat on the cylinder casting.

The crankshaft ran in babbitt-filled bearings the bronze shells of which showed no wear as there was nothing in frictional contact with them. The main journals also showed so little wear when they were examined at the time of taking down the engine that it was not considered necessary to do anything to them, especially as any work upon the shaft would put the engine out of service. New babbitt in the shells put the main bearings in shape to go back.

Again at 12 o'clock, with every part tested to make sure that all would go together without delay, the engine was stopped and the new parts assembled. The opposite side was disconnected at crank and eccentric and the crosshead blocked against movement, but no part was dismounted as we wanted to make sure that the new engine was going to run. Upon starting at 1 o'clock no trouble was experienced by anybody but the engineer, who was depressed by the absence of noise, a depression no doubt eradicated by time.

Repairing the Second Engine

The new engine ran quietly and steadily all that afternoon and all the next morning until, at noon, the other side was dismounted to receive the same course of treatment. With all the special tools ready, many of the new parts nearly done (for when I had to make a new part for the first engine I had roughed out a duplicate for the other one) and with the advantage gained by the experience in knowing just what I was going to do, the second engine was put in shape in a few days. Not one minute of running time was lost by the shop and except for the three noon hours there was no overtime work done.

I saw that little engine last summer. It was clattering away as noisily and blowing away steam as recklessly as before I made that repair, but except for minor adjustments there had been no work expended upon it since that far-off March in 1897 when the engineer blamed me for "spoiling" his engine because "he couldn't tell whether it was running or not without looking at it."

The Law of the Involute Curve

Principles Developed in Preceding Article Applied to Generating Gear Teeth—Adapting the Milling Machine to Cutting Gear Teeth with the True Involute

By O. G. Simmons
Vice-President and General Manager,
Simmons Method-Hob Company

FROM THE theory of the involute curve developed in the preceding installment published on page 801 of *American Machinist*, it is apparent that involute curves may be generated in a lathe or a milling machine. In the case of the lathe, a piece of cardboard or metal plate is attached to the faceplate and a scriber or cutting point is placed in the toolpost so that the point is high enough above the center to coincide with the tangent line in our proposition of Fig. 1 in the preceding article. The proper change gears are placed in position to give the required lead to the cutting point. If the faceplate is rotated, the cutting point will generate an involute curve, which we now see is identical with the method which Fig. 1 demonstrates.

If, instead of a cutting point, we were to substitute an end mill, we could generate a right- and a left-hand involute curve and also the clearance space between these curves by one pass of the end mill across the blank being operated upon. Evidently, these curves can be generated according to the proposition illustrated in the previous article in Fig. 2, where two points could be used, one to generate the curve of one hand on approaching the blank, and the other the curve of the other hand on leaving the blank.

It is evident also, that the principle of Fig. 3, in the previous article could be used as that underlying the generation of involute curves, with the use of an end mill or a reciprocating planer tool as the cutter in a milling machine. This method is illustrated in Fig. 4 in which are clearly shown the end mill and the gear being operated upon, as well as the change gears necessary to obtain the lead of the involute curve. The position of the end mill can also be seen. The end mill rotates about a vertical axis, while the gear blank being operated upon has not only its rotary movement, but also a lineal movement, which is identical with the method Fig. 3 describes.

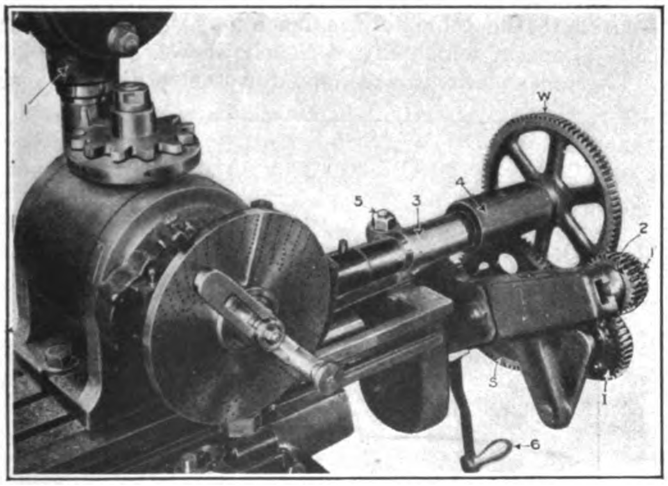

FIG. 4—MILLING MACHINE ADAPTED TO CUTTING AN INVOLUTE CURVE ON GEAR TEETH

Instead of a single marking point, however, which was shown in Fig. 3, we have an end mill provided with a series of cutting points rotating about a fixed axis. The fixed axis, of course, is the axis of the spindle of the vertical milling attachment indicated by the numeral *1* in Fig. 4. The end mill and the involute curves of the gear teeth are also visible. The axis of the gear shown is parallel to the axis of the spindle of the vertical milling attachment. This is accomplished by simply setting the spindle of the index head in a vertical position, by means of the degree graduations provided on all index heads.

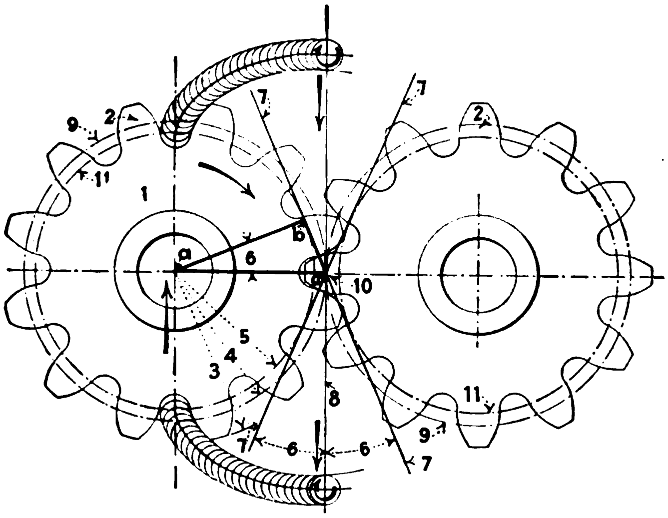

FIG. 5—DIAGRAM OF GEARS SHOWING BASE CIRCLE AND PRESSURE ANGLE

The writer believes that we should not leave this subject until the generation of the involute curve by mechanical means in an actual machine is described, as such a matter will, undoubtedly, result in a clear and precise understanding of the curve and its underlying law. Let us take, therefore, one concrete embodiment of the idea, as illustrated in Fig. 4, and generate the involute curves on the teeth of the gear shown.

Let us assume the gear is to have 12 teeth, 2.5 diametral pitch and a pressure angle of 22½ deg. Such a gear is illustrated in Fig. 5 in which the numeral *1* indicates the gear provided with the teeth *2*. The numeral *3* indicates the radius of the circle which forms the periphery of the gear, while the numeral *4* indicates the radius of the pitch circle, and the numeral *5* the radius of the base circle.

The base circle of the gear *1*, Fig. 5, is the evolute of the involute curves forming the faces of the teeth *2*. In order to determine the lead of the involute curve forming these faces, it will first be necessary to determine the diameter of the base circle. This measure of the diameter of the base circle is easily determined from the pitch circle diameter and the angle of pressure, both of which are known or determined from the data given

previously. The pitch circle diameter is found by dividing the number of teeth in the gear by the diametral pitch, giving the formula:

$$D = \frac{N}{P}$$

D = pitch circle diameter
P = diametral pitch
N = number of teeth
Substituting the values for the letters, we have:

$$D = \frac{12}{2.5} = 4.8 \text{ in.}$$

Thus, the diameter of the pitch circle is found to equal 4.8 in., and the measurement of the radius *4* of the pitch circle will equal 2.4 in. Having established this measurement, the measurement of the radius *5* of the base circle is easily determined by means of the right angle triangle *abc* with the right angle at *b*. The pressure angle is equal to 22½ deg. so that the pressure lines, indicated by the numeral *7*, have been constructed with an angle *6* equal to 22½ degrees.

It is to be noted that the pressure lines become such only when they intersect each other at the common point of tangency *10*, of the line *8* and the pitch circle *9*. It is evident that angle *bac* is equal to 22½ deg. and that the side *ab* is equal to the measurement of the radius *5* of the base circle. Further, the side *ac* is equal to the measurement of the radius *4* of the pitch circle *9*. The known elements of the triangle *abc* having thus been established the following equation is evident:

Side ab = side $ac \times \cos bac$.

Substituting values for the letters, we have the following covering the special case under consideration:

ab = radius *5*
ab = 2.4 in. × cos 22½ deg.
Radius *5* = 2.4 in. × 0.92388
Radius *5* = 2.217312 in.

From these formulas, the diameter of the base circle which is the evolute being considered, equals twice the measurement of the radius *5*, or 4.434624 inches.

Direct Method of Finding Involute Lead

The foregoing details have been given in the interest of simplicity and to make clear all the steps covered in arriving at the measurement of the diameter of the base circle. A more direct and general method to arrive at this measurement now presents itself. Advantage is taken of the two given factors controlling the diameters of all base circles. As the pitch circle diameter is always known or quickly ascertained, and the pressure angle is always known, no further information is necessary. The diameter of any evolute or base circle may be expressed as follows:

$D'' = D \cos \alpha$
D'' = diameter of evolute
D = diameter of pitch circle
α = pressure angle

According to the law of the involute, stated in the previous article, the lead of any involute curve is equal to the perimeter of the evolute. Now our evolute is the base circle which we have under consideration, and its diameter equals 4.434624 in. To obtain the perimeter measurement, we have only to multiply the diameter measurement by 3.1415926535 which results in a lead of 13.9317821794347840 in. for the involute.

Ordinarily, the constant 3.1416 is close enough for machine construction purposes. It is usually found necessary to drop some of the decimals as we shall find in our present case. We may write our involute lead as equal to 13.9317 in. which will still be away inside any accuracy required or possible with the commercial manufacturing machines at our disposal.

It now becomes necessary for us to determine the change gears to produce the desired lead as just determined. The methods and rules for determining such change gears are given in several publications on milling machine practice and in many handbooks. These may be referred to by the reader, who, without doubt, is already thoroughly familiar with the subject. We have, therefore, only to look up the chart furnished with milling machines and, under the table of "leads," we find that the nearest lead to the one we desire is 13.933. This lead is near enough as it gives an error of only 0.0013 in. in over 13 in. The change gears to produce this lead, taken from the table, are:—

$$\frac{\text{Driven}}{\text{Driver}} \quad \frac{86 \times 56}{48 \times 72}$$

We now place these gears as indicated: The 86 gear on the worm indicated by the letter *W* in Fig. 4; the 56 gear on the stud indicated by the numeral *2*; the 48 gear on the stud indicated by the numeral *1'*; and the 72 gear on the screw which the letter *S* indicates.

We must now determine whether or not the rotary movement of the index head and the linear movement of the table are according to the proposition of Fig. 3 in the previous article. The evolute, we know, must roll on the line tangent to it. As becomes evident upon inspection, an idler gear must be introduced into our train of gears to give us the relative movements desired. We, therefore, place the idler gear, indicated by the letter *I* in Fig. 4, in our train of gears so that it engages the gears indicated by letter *S* and numeral *2*.

Milling machines have not been designed for these methods of generating involute curves. It is necessary, therefore, in order to generate right- and left-hand involute curves with a single pass across the end mill, to introduce an extension shaft secured to the worm shaft of the dividing head and to journal the extension shaft in a bracket secured to the table. The shaft referred to is indicated by the numeral *3* and is journaled as shown, in the bracket *4*. This bracket is secured to the table of the machine by means of the bolts *5*, one of which Fig. 4 clearly shows.

The index plate is arranged for twelve divisions, as

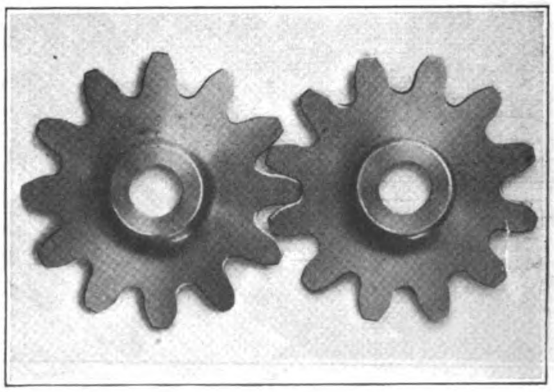

FIG. 6—PAIR OF PINIONS CUT ON A MILLING MACHINE

twelve is the number of teeth in our gear. We are now ready to generate involute curves according to the method illustrated in Fig. 3 of the previous article, using the mechanical means just described.

With reference to Fig. 5, it is noted that our evolute

or base circle is imaginary only, although it is represented by means of the circle *11*, and is well within the diameter of the blank which has the radius *3*. Mechanics will understand generally that the material to be removed between the teeth will require several cuts. Let us assume that the depth of the tooth, in order to have the center of the end mill coincide with the line tangent to the evolute at the proper depth, will equal 0.7885 inches. The center of the end mill may be well inside the tangent line without materially affecting the involute curve being generated or the thickness of the teeth of the gear.

Having decided the depth of the tooth, we can see that by removing 0.110 in. we can make seven cuts and a final cut of 0.0185 in. to finish the gear complete, or eight cuts in all. A left-hand two-lipped slotting end mill, of the high speed steel type, will accomplish nicely the first seven cuts, and a left-hand spiral end mill, shown in Fig. 4, will complete the last or finishing cut.

How Material Between Gear Teeth Is Removed

Proceeding on this theory we move in the table until the mill just touches the blank. To accomplish this, it is necessary to move the table longitudinally by means of the crank handle *6*, in Fig. 4. This will cause the blank to roll past the end mill. When the mill just touches, the graduated dial on the transverse screw should be set at the zero mark. If a left-hand end mill is used, the blank should be moved to the right of the mill to clear the mill, and the table should be moved in the 0.110 in. for the first cut. The feed is then thrown in so that the table moves to the left rolling the blank over the left-hand end mill.

When the mill leaves the blank, the machine should be stopped and the blank should be returned to its original position to the right of the mill and then indexed. The machine should be started and the cut taken for the second tooth, and so on until the first cut on all teeth has been completed, whereupon the table is moved in for the second cut and the cycle repeated until the gear is finished.

It is now obvious that we have, by positive mechanical means, generated true involute curves, the truth of which are dependent only upon the accuracy of the apparatus used. In other words, the inaccuracies of our apparatus are unquestionably reflected in the involute curves generated in the blank but to a smaller degree. A pair of twelve tooth pinions cut as previously described is shown in Fig. 6. The involute curves are clearly distinguishable as well as the circular curve lying below the base circle, which the line drawing of Fig. 5 shows.

Method Practical for Large Gears

The foregoing method is not a commercial possibility on the ordinary run of gears. It is practical, however, for large gears where the cutter cost becomes a factor. This method is used in the plant of the Simmons Method-Hob Co. to generate the curves on circular gear cutters by means of metal cutting tools before the cutters are hardened, and by means of abrasion or grinding after hardening. In this latter event, a disk emery wheel is substituted for the end mill.

We know now what an involute curve is and we are able to define it. We know the law underlying all involute curves and we can generate such a curve by a positive mechanical means admitting only of infinitesimal mechanical errors in which the human equation does not enter. We are now able to refer to an involute curve in terms of its lead. When one says an involute curve has a lead of 15 in., what is meant is immediately pictured in our minds just as though one were to say a circle is 15 in. in diameter.

A circle is referred to in terms of its diameter. We can, therefore, refer to an involute curve in terms of its lead and have an equal and complete understanding of what is meant. Many things are thus immediately given light, so that we are now prepared to apply this curve intelligently to the teeth of gear wheels.

Brief Reports Save Time

By Frank V. Faulhaber

In making out reports in the machine shop some foremen become vexed because of the extra time involved in the work. On close study it has been found that in some plants the reports that are sent in are entirely too long. Some foremen will take longer to get over their reports and this naturally points to another inefficient system. Too, when foremen are irked because of this problem, they naturally will cut themselves away from the pencil wherever possible and this means they will not take notes for their own benefit. They will thus neglect many important memorandums, such as the requirement of new stocks, etc.

In one progressive plant the superintendent has passed around the advice that reports be made brief as possible, thus to economize time. This executive observed: "It is laughable when you read some of the reports sent. We require reports from our assistant foremen, too, and it seems some of the fellows make large reports simply to have something to send in.

"On the other hand there are executives who will undervalue the importance of these reports. We find it necessary to remind them that they should send in all possible reports that in any way will help us in getting out better work, more of it, and to enable us to keep accurate tab on results. By educating each of our executives on sending in regular reports, brief, yet not overlooking anything important, we are getting more cooperation from them. A few hints have helped us materially in getting terse reports, thus saving time of the one who writes them and those who read them."

Firing Without Sufficient Cause

By A. W. Forbes

I have noted a number of articles in your paper in which it is stated that men are fired from industries with but little cause. And now the leading editorial states that it is still quite common to fire a man because "There is temporarily something wrong with his headstock."

I wonder if this can be true. Of course most persons that are fired have a long record of unsatisfactory work which culminates in a single act, and they often think that it is the single act for which they were fired. But did you ever know of a case where you knew the side of the management where anyone was fired for anything of a temporary nature? I have known of one such case. In a neighboring shop a new man set the building on fire through carelessness before he had been working long enough for the management to find out whether he was a good man or not. They did not keep him long enough to see. This is the only case I have known of.

Germany—Exports and Imports of Metal Working Machinery—("Maschinen zur Bearbeitung von Metallen")

TABLES V AND VI

Exports Country	1909 Quantity 100 Kgs.	1909 Value 1000 Marks	1910 Quantity 100 Kgs.	1910 Value 1000 Marks	1911 Quantity 100 Kgs	1911 Value 1000 Marks	1912 Quantity 100 Kgs.	1912 Value 1000 Marks	1913 Quantity 100 Kgs.	1913 Value 1000 Marks
Belgium	28,040	3,344	39,832	4,532	41,209	4,149	39,926	4,063	66,715	6,600
Bulgaria	1,606	304	1,701	344	2,402	245	2,348	247	856	104
Denmark	6,880	1,132	6,903	1,194	7,496	726	8,477	874	10,707	1,062
France	51,491	5,497	68,794	8,062	82,575	8,356	91,945	10,036	119,065	12,726
Greece	472	78	489	72	350	39	672	79	736	83
Great Britain	12,435	1,716	23,805	2,744	19,623	2,630	26,162	3,857	55,157	5,900
Italy	63,352	8,324	62,754	8,825	101,580	7,570	58,893	6,159	57,325	5,906
Netherlands	13,650	1,955	16,286	2,370	19,028	1,953	19,357	2,118	36,412	3,582
Norway	3,736	592	3,932	629	6,275	663	8,617	909	7,163	862
Austria-Hungary	71,700	10,294	85,510	11,415	97,648	10,461	107,631	11,689	113,089	12,440
Portugal	1,360	221	1,366	218	1,722	252	1,511	254	2,290	322
Roumania	3,289	487	3,603	566	6,253	577	8,293	831	5,324	561
European Russia	30,916	4,767	42,238	6,779	65,500	7,871	81,624	8,975	130,770	15,496
Asiatic Russia	354	63	527	116	876	89	......	......	......	......
Finland	3,040	597	2,904	477	2,562	275	2,708	325	3,203	356
Sweden	9,134	1,474	8,684	1,348	10,321	1,127	12,402	1,500	17,170	2,095
Switzerland	23,916	3,641	23,684	3,678	26,869	3,096	25,612	3,246	25,905	3,062
Serbia	516	74	800	142	790	74	614	76	259	30
Spain	6,752	952	5,083	780	6,883	775	9,789	1,225	15,060	1,825
Turkey in Europe	621	122	609	110	2,866	343	3,344	417	1,392	168
Turkey in Asia	222	40	530	89	485	48	......	......	......	......
Egypt	503	78	180	39	586	60	310	39	799	70
British South Africa	405	43	662	86	253	32	449	54	360	49
German Southwest Africa	443	48	900	120	646	61	507	57	590	64
German East Africa	......	......	......	......	......	......	940	106	823	93
Tunis	......	......	......	......	......	......	58	8	501	58
British India	434	79	4,534	407	1,132	122	567	74	1,308	136
China	1,298	153	2,397	241	2,704	423	650	95	2,257	240
Japan	1,104	173	2,455	283	4,286	518	7,657	959	13,536	1,106
Dutch East Indies	1,597	218	1,810	272	2,279	241	3,028	328	4,237	485
Siam	1,446	120	303	48	95	15	......	......	......	......
Argentina	9,937	1,616	12,249	2,000	16,245	1,835	15,235	1,777	14,465	1,672
Brazil	3,448	599	5,233	834	5,473	624	10,718	1,480	12,776	1,719
Canada	207	23	350	43	715	86	626	82	785	91
Chile	1,177	230	1,160	215	1,634	212	3,286	342	2,819	329
Mexico	566	96	625	93	576	67	466	83	523	84
Uruguay	488	120	1,264	224	1,394	151	1,408	177	1,194	135
United States of America	6,501	720	8,729	1,091	6,662	944	9,819	1,171	12,591	1,709
Australia	629	98	1,364	164	1,992	263	2,368	276	2,042	244
Total	365,102	50,320	447,037	60,991	553,153	57,271	570,808	64,306	743,358	81,837

Note.—No statistics are available for the period 1914 to 1919 inclusive. Returns for 1920 and 1921 do not show this classification in the figures showing exports.

Imports Country	1909 Quantity 100 Kgs.	1909 Value 1000 Marks	1910 Quantity 100 Kgs.	1910 Value 1000 Marks	1911 Quantity 100 Kgs.	1911 Value 1000 Marks	1912 Quantity 100 Kgs.	1912 Value 1000 Marks	1913 Quantity 100 Kgs.	1913 Value 1000 Marks	1920 Quantity 100 Kgs.	1920 Value 1000 Marks	*** 1921 Quantity 100 Kgs.	*** 1921 Value 1000 Marks
Belgium	1,759	214	1,134	156	2,044	260	2,588	323	2,356	340	......	......	......	......
Denmark	651	61	422	47	332	38	483	58	391	49	......	......	......	......
France	1,768	292	1,561	218	2,722	383	3,034	486	2,207	363	......	......	......	......
Great Britain	10,066	896	6,150	683	9,430	853	7,104	816	9,694	1,015	......	......	......	......
Italy	445	65	198	37	620	72	701	92	222	36	......	......	......	......
Netherlands	149	28	128	26	574	80	378	69	690	83	4,011	......	206	......
Norway	759	65	1,666	141	1,270	117	112	21	63	10	......	......	......	......
Austria-Hungary	2,259	328	6,213	573	1,745	258	2,161	325	1,596	332	*1,999	......	1,086	......
Sweden	522	80	939	108	483	86	293	66	497	89	1,101	......	......	......
Switzerland	1,447	272	1,545	308	2,945	491	3,913	731	4,120	718	741	......	1,294	......
United States of America	25,485	3,661	32,199	4,594	41,938	5,172	53,994	7,126	41,995	5,804	......	......	......	......
Other Countries	......	......	......	......	......	......	......	......	......	......	2,253	......	2,210	......
Total	45,478	5,988	52,349	6,917	64,328	7,848	75,036	10,161	64,270	8,911	10,105	**	5,121	14,206

*Austria only. **No value given for 1920. ***Statistics are for period May to December inclusive for 1921.

S. A. E. Production Meeting Papers

Abstracts of Eight of the Principal Papers Presented at the Production Meeting of the Society of Automotive Engineers, Detroit, October 26-27

Some Causes of Gear-Tooth Errors and Their Detection

By K. L. Herrmann
Engineer, Studebaker Corporation of America

It is the purpose of this paper to show that production variables have a much greater influence on gear sounds than changing pressure-angles, steel or tooth-form details; also, by showing the errors present, to obtain definite help from the gear-cutting tool and the machine designer. We will confine this discussion, for the time being to the transmission, which is the simplest type of gearing used in the motor car.

It is not sufficient to check gears for spacing error from tooth to tooth. It is very desirable to check the accumulated error of a number of teeth, because a gear may vary 0.001 in. from tooth to tooth. With eight successive teeth each gaining 0.001 in. on the side of the gear and a similar number of teeth that may be losing 0.001 in., a total error of 0.016 in. might be imparted to the driven gears.

Figure 1 illustrates a very simple device that has been used for checking tooth spacing. The gears are mounted on a bushing and one tooth comes against a stop. A dial indicator is arranged so as to be in contact with some tooth one-fourth, one-third or one-half way around the gear. When the dial indicator is set at zero, with the tooth against the stop at any one point, the distance between the two points can be measured and, if the gear be correct for indexing, placing any of the two teeth in the gear in similar positions should not cause the dial indicator to vary, especially if the gear runs true.

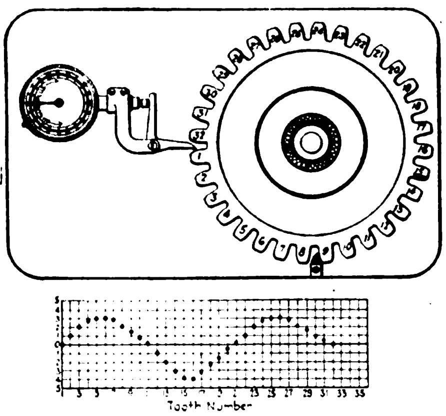

FIG. 1—CHECKING TOOTH SPACING

When the gear is first put on the indicating apparatus, the dial indicator is set at zero. We then put a mark at zero on the chart in Fig. 1 for tooth No. 1. The next step is to index the gear around one tooth. Any reading obtained is marked above the tooth number in the vertical line. We next index the gear around to tooth No. 3 and again mark the dial-indicator reading opposite the number of thousandths of an inch that it may show. The gear is then indexed to teeth Nos. 5, 6, etc., until all the teeth on the gear have been indexed.

For the purpose of record, we now have a chart showing the accumulated variables. It will be seen from Fig. 1 that at no point is the spacing variable as great as 0.001 in. between any two teeth, but it can be in error a total of 0.008 in. or more when the error between the several teeth has accumulated.

Hum or sing is not nearly so difficult to analyze as the matter of rattle in a transmission gear. If the teeth are not correct in shape and the gears are under a slight load, there may be 250 blows per sec. under certain conditions, which we are told corresponds to the tone of middle C on the piano. Should fewer teeth go into and out of mesh, and this may be caused by a slower speed, a much lower pitch can be produced.

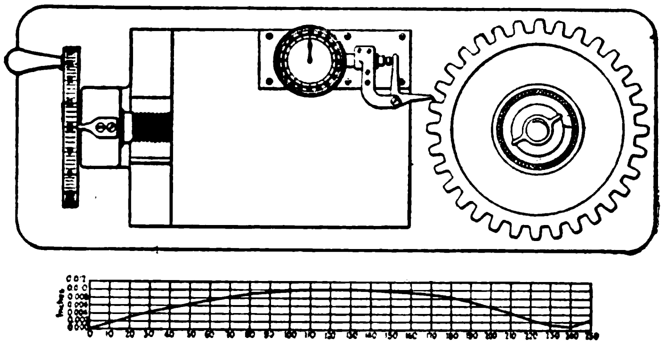

FIG. 2—ANALYZING TOOTH FORMS

In a similar way, because of the speed reduction that occurs in the usual type of transmission between the drive pinion and its countershaft, the tone produced by the reverse idler is very low and, instead of producing a hum or sing, it will produce what we usually call a growl. Errors in the sliding gears, because of their higher speeds, will produce higher pitch growls and approach a hum.

A great many instruments have been developed for the purpose of analyzing tooth-forms producing these sounds. The one that we have worked out and have

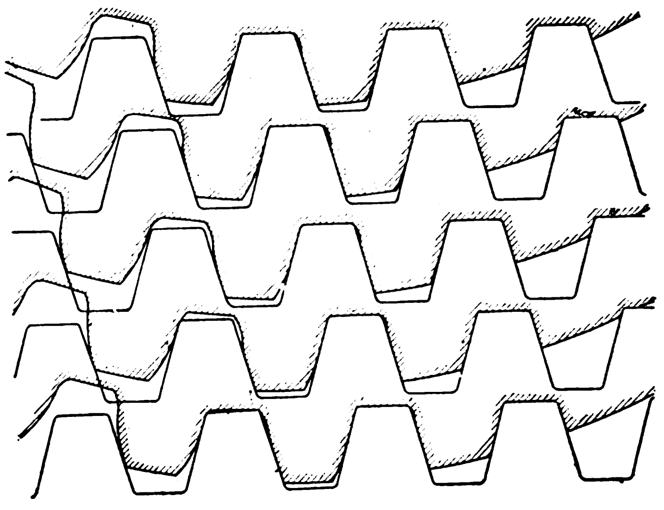

FIG. 3—OUTLINE OF TOOTH FORM PRODUCED BY HOBBING

chosen to use is shown in Fig. 2. It consists of a dial indicator mounted on a guided slide. We place the gear in a definite positon with respect to the indicator, start at the point of the tooth and set the indicator at zero.

The slide is then moved toward the gear 0.010 in. and the indicator-reading marked on the chart shown in the lower portion of Fig. 2. The slide is then moved 0.010 in. more, the reading is marked again, and this is continued until the bottom of the tooth is reached. By taking the gear that has just been charted off the bushing and placing another gear in its place, other tooth-forms will be compared with the first.

The causes of the errors referred to are various. Some of them occur in hardening, some in the cutting machines and some in the cutters. We have found these errors in all of the types of machine that we have used. For the purpose of this discussion we are selecting a hobbing machine.

The hob is a generating tool that produces a gear such as is shown in Fig. 3. It will be seen readily that if all tooth-heights of the hob are the same, each hob-tooth

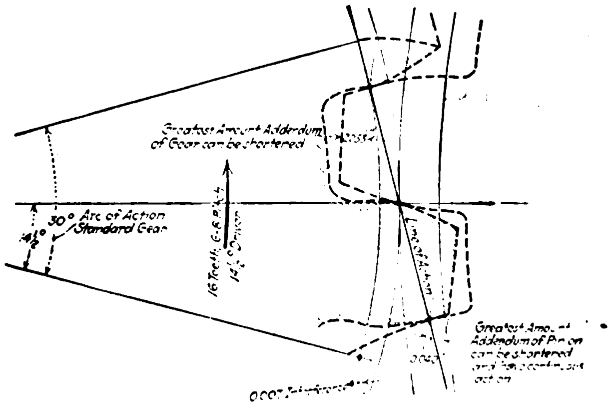

FIG. 4—LAYOUT TO DETERMINE TOOTH LENGTH

generates, roughly, a flat in the tooth-form. If any one of the teeth in the hob is high, a wider flat will be produced. Should the tooth-heights be correct and the hob be mounted in the machine with a run-out, a leaning tooth can be produced, depending on the sideways setting of the hob with the ge r. Also, should the hob be correct and the end-thrust collar in the hob spindle be out of parallel, giving the hob a slightly reciprocating motion with each revolution, an error can be produced that may compensate for the hob run-out or may add to it.

Should the thrust collar at the rear end of the spindle be adjusted loosely so that the spindle may have end-play, the hob, as it cuts on one side, will be forced over and then back with each tooth of the gear and produce corresponding errors in the tooth-form. Again, if the

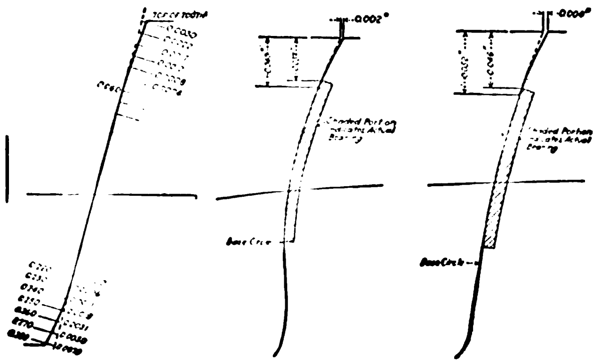

FIG. 5—HOB FORM SELECTED FROM LAYOUT. FIG. 6—TOOTH FORM OBTAINED FROM HOB OUTLINE

gears in the hob-grinding spindle have inherent index-errors in them, or should the gears driving this gear be concentric or improperly spaced, their errors will be transfered to the different teeth of the gear being cut.

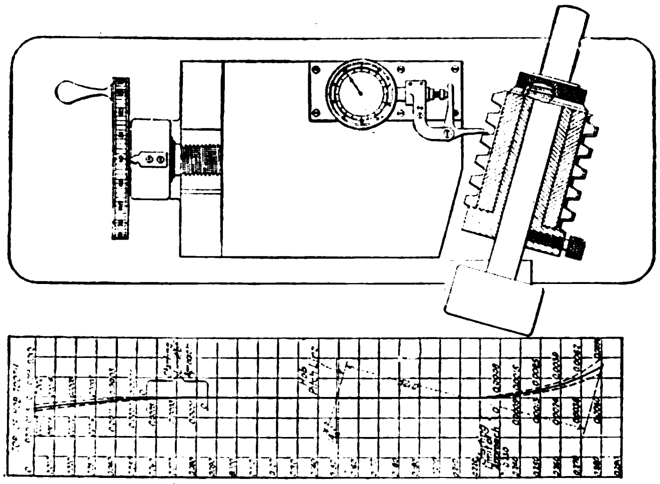

FIG. 7—HOB CHECKING DEVICE

Another important element in connection with the hob is the fit of the hob spindle.

We will all agree that, should the hob spindle be tight for a certain portion of the revolution and loose for a certain other portion of the revolution, a sagging will occur in the driving-gear train which will be very detrimental to the tooth-form. Some hobbing machines are built so that the bevel gears in the hob drive-spindle give a thrust in the opposite direction to that given by a spiral pinion driving a hob-spindle gear. This permits a back-and-forth movement of a hob-spindle drive-shaft and sometimes leaves its impression on the tooth-form.

Without going into the details concerning the other gears in the hob-spindle train, we might consider the influence of the thrust collar on the fits of the work spindle. In most hobbing-machines the bearings are kept fairly tight, and a great many operators insist that the hob spindle be kept warm. This also applies to the worm-shaft driving the wormwheel and, to a certain extent, to the work spindle.

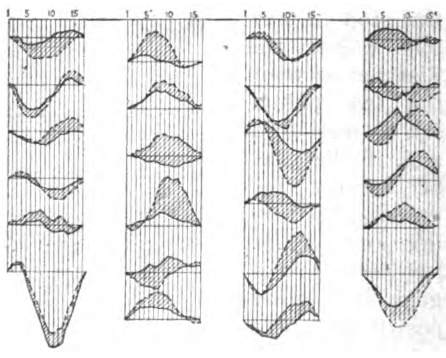

FIG. 8—VARIATIONS IN 24 GEARS

Unless the machines are extremely well adjusted, the thrust collars on the spindles so fitted score very easily and cause the spindles to be tight or loose at various portions of their revolutions. This causes a corresponding sag in the gears driving the index wormwheel and seems to be the main cause of the index errors already referred to. Another source of error is looseness in the gibs of the hob saddle.

It is very difficult to move the hob slide across the face of the tooth without having some play between the gibs. This amounts, in a very similar manner, to the error that is obtained by having end-play in the hob spindle. Another contributing error to tooth-form is depth of cut. There will be considerable error in the

tooth-form if the hob is sunk several thousandths of an inch too deep.

Should the hob be straight-sided, the pressure-angle will increase with the depth of the cut and decrease as it is raised above the pitch-diameter. Another factor having considerable influence is the outside support for the hob spindle. We have had considerable difficulty in placing this outboard support of the hob spindle back in exactly the same place, giving us exactly the same condition of hob spindle as before.

When the work spindle is caused to rotate ahead of or behind its proper position, we necessarily have certain tooth-form errors in addition to index errors, and also in addition to those produced by the hob, its spindle and driving mechanism. There are conditions under which some of the errors referred to are counterbalanced by other errors. There are conditions, however, in which these errors accumulate. Considering the number of gears in a hobbing machine and the number of possibilities for errors outside of these gears, it is largely a matter of chance whether suitable combinations can be obtained to produce proper tooth-forms.

Details of Tooth-form

The details of tooth-form are of some importance. Continuing with transmission gears, Fig. 4 shows the first layout which we make. This is with a view to determining the amount of tooth length necessary to give a 100-per cent arc of contact. With this information in hand, we select a hob form such as is shown in Fig. 5 and, using this on paper, we roll out two tooth-forms as shown in Fig. 6, one for each of the gears that are intended to be in contact with each other. The next step is to roll these gears on each other to determine the interferences, if any, and the amount that they are topped-off; then, if necessary, the hob form is modified and the same procedure carried through. When the hob form is established on paper in this manner, it is charted as shown in Fig. 7 and the hob supplier is asked to conform to this shape. Definite tolerances are given for the amount of variation from this form. On receipt of the hob, we inspect this form on a hob-checking apparatus very similar to that which we use for checking gear-tooth forms, a drawing of which is shown in Fig. 7. If these conform to our standard requirement, it is expected that the hob will be satisfactory.

Hardening of Gears

Relative to the errors produced by hardening, we have prepared a number of charts showing the condition of the gear in the green and the condition of the gear in the hard. The question as to whether oil-treated steel is better than carburized is still unanswered as regards warpage. We have hardened more than 5,000 gears of different brands of steel and carefully checked them. We find that there is very little difference in the warpage under the same hardening conditions.

The necessity for grinding gear-tooth forms depends largely on our ability to cut and harden gears, maintaining definite shapes. However, there is a large difference in the number of rejections that we have from gears ground by different processes. Our reports at this time show that out of 5,000 gears ground by one method we have had a 14-per cent rejection. This is slightly greater than that which we have had from the hob gear without grinding. By another method of grinding of a similar number of gears, we have had less than a 0.5-per cent rejection, as well as more satisfactory gears. In the first case, four gears of the transmission were ground, and in the second case only two gears of the transmission were ground. All transmissions were passed by the same inspector and inspected to the same standards. We, of course, are looking forward with great interest to the continuation of our experiment on gear-grinding.

Some Unique Features of Automobile Production

By William Dunk
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All engineers realize that there are a large number of problems to be met in the production of automobiles, and that the majority of these problems are much the same with the H. H. Franklin Mfg. Co. as with any other. I will endeavor, therefore, to confine this discussion to the following topics that are somewhat unique in Franklin automobile designs; namely, (*a*) the production of air-cooled cylinders, (*b*) the making of case-hardened crankshafts, (*c*) the machining of duralumin connecting-rods and (*d*) experiments with hot-swaged rear-axle drive-shafts.

Production of the Air-Cooled Cylinder

The design of the Franklin engine necessitates the use of unit-cylinder construction rather than the regular block-cylinder design. This fact makes the production of the cylinder a somewhat different problem from that of machining a block casting. In the Franklin cylinder, the head is cast integrally with the body of the casting and steel cooling fins are cast in the outer surface of the cylinder-wall.

The foundry practice in connection with the production of these castings is of interest. The mold is composed of three distinct sections, the lower section being an assembly of dry-sand cores for making the head of the cylinder and the valve ports. Next above this section is a green-sand section containing the cooling fins, and the upper section of the mold is a green-sand section for the neck of the cylinder between the cooling fins and the bottom flange, the cylinder of course being cast in an inverted position. The core assembly for the head of the cylinder is made up of five unit-cores, made separately and assembled by pasting-in an accurate pasting jig so that the valve port cores are held accurately in position while drying. The valve-port cores are provided with prints to locate the upper end of the main cylinder-barrel core. For this reason it is necessary to be very accurate in the location of the port cores.

The cylinder pattern is milled longitudinally with the proper number of gooves to receive the vertical cooling-fins. These grooves are $\frac{1}{16}$ in. in depth, which corresponds to the amount that the fin is imbedded in the cylinder-wall. The green-sand section of the mold containing the cooling fins is made on an air-operated jar ramming-machine provided with a sand hopper directly above the mold. A very small amount of sand is used in this section of the mold, not over 2 in. of sand being provided outside of the diameter of the

cooling fins. The fins are held in place in the cylinder pattern by simply wrapping a piece of soft iron wire around them and twisting the ends tight. This wire remains in the mold until the casting has been made, and serves to keep the section of green sand that lies within the cooling fins from sagging below the rest of the mold. The upper section of the mold is also made in green sand and is located on the center section by taper dowels. The last operation in making the mold is the placing of the cylinder-barrel core and the strainer-gate core through which the metal is poured. The cooling fins are made of ordinary cold-rolled strip-steel which has been tinned and folded to a right angle about 5/16 in. from one edge. These cooling fins, when placed radially about the cylinder pattern, form a completely enclosed air-jacket.

The greatest source of casting loss that we experience in making this piece is caused by loose flanges. Unless the flanges extend at least 1/16 in. below the surface of the cast iron, they will not be properly held in place.

The analysis of iron used in making the Franklin cylinder is approximately as stated in Table I.

TABLE I—ANALYSIS OF IRON USED IN THE FRANKLIN CYLINDER

Constituents	Per Cent
Silicon,	2.00
Phosphorus,	0.50
Manganese,	0.50
Sulphur,	0.10
Carbon,	3.25

The machining operations are as follows: The cylinder casting is first mounted in a chucking fixture on the table of a small vertical boring-mill, and the bottom flange is faced and counterbored. This counterbore is used for locating the cylinder while drilling the four hold-down holes on the second operation. These hold-down holes are used for locating the cylinder for the boring operation, which is performed next. Our present method of boring the cylinder consists of making four separate cuts in the cylinder under a single-spindle Baker boring-machine. The necessity of making this number of cuts is caused by the fact that the cylinder-wall has no support to prevent its being split, if a heavy cut were attempted. The thickness of the metal of the finished cylinder between the cooling fins and the cylinder bore is only 3/16 inch.

A new cylinder-boring machine has just been completed and tested which makes five separate cuts in the cylinder, operating on five separate cylinders simultaneously. The first spindle of the machine rough-bores, and removes about 1/8 in. of metal from the cylinder-wall. The second spindle rough-bottoms the cylinder to within 1/32 in. of the finished depth. The third spindle semi-finish bores, and leaves 0.035 in. of metal for finish-boring. The fourth spindle finishes the bottom of the cylinder to depth, and the fifth finish-bores to grinding size. We are leaving about 0.007 to 0.010 in. of metal for grinding at present, and we may find it possible to reduce this to a maximum of 0.005 in. The fact that we are dealing with unit cylinders allows us to center each cylinder very accurately for the grinding operation. The complete boring operation as performed by the new cylinder-boring machine occupies about 1½ min. per cylinder.

The cylinder is ground on the standard type of Heald cylinder-grinding machine equipped with a special small table for unit-cylinder work. It is held against an ordinary angle-plate grinding-fixture, and is located with a plug through a master bushing inserted in the grinding fixture. Cooling water is flowed on the outside of the cylinder during the grinding operation. The valve ports in the cylinder are reamed holes about 2½ in. in diameter and 1 in. in depth. They are held to a limit of 0.001 in. to provide a sufficiently tight joint with the extension pieces that attach them to the suction and exhaust manifolds. A special double-head machine was built to bore and ream the port holes with accuracy required.

Briefly this machine consists of two three-spindle movable-heads operating toward a central holding-fixture on which four cylinders are mounted. There are three working positions and one loading position. The central fixture is arranged so that it can be indexed at the end of each stroke of the machine. The first pair of working spindles rough-bores the port holes to within 0.035 in. of the finished size. The second spindle does not remove any metal from the diameter of the hole but simply performs the bottoming operation. The third pair of spindles finish-reams the holes to size. By arranging the machine to operate on both ports at once, the thrust of the cutters has been neutralized almost exactly, because the ports lie nearly opposite each other across the cylinder casting. The cutters used in this machine for all operations are a standard type of shell-end mill, and they seem to give very satisfactory results. It is not necessary to change cutters oftener than one set to each 350 cylinders. The capacity of this machine is one complete cylinder every 40 sec. A particularly rapid means of loading and unloading the cylinder is necessary, to allow the operator to perform these operations during the cycle of the machine.

The valve-stem guides are separate castings machined ~~complete and pressed into place~~ in the cylinder casting, the final reaming operation being performed in the valve-stem holes after the guides are pressed-in. The seating and other minor operations on the cylinder are performed in the usual manner and do not require any special mention.

The Case-Hardened Crankshaft

Another interesting manufacturing detail is the Franklin case-hardened crankshaft, which we have been producing for the past two years. The primary object in incorporating this type of shaft is naturally to prolong the life, so far as possible, of the bearing surfaces. Preliminary experiments developed the fact that if a crankshaft can be hardened to a scleroscope hardness of between 80 and 100, the life of both the main bearings and the crankpin bearings can be prolonged considerably. In some of our test cars as much as 50,000 miles was covered without any adjustment of bearings being necessary.

In putting a proposition of this kind into production, a number of problems had to be met concerning which very few data were obtainable. The crankshaft forging has a carbon content of from 0.15 to 0.25 per cent and the required depth of carburization is specified at 1/16 inch.

In the manufacture of this shaft, the forging is first machined to within 0.040 or 0.045 in. of its finished diameter, with the exception of the flange and threaded ends which are left in the rough. The forging is then ready for the copper-plating operation, which is applied to prevent carburization of all parts of the shaft except the bearing surfaces. Several ideas were tried out in connection with preventing the copper-plating of these surfaces during the process, and we finally adopted the method of wrapping all bearings with pure gum rubber

held in place with clips. The rubber bands are easily removed and can be used again and again.

In carburizing the shafts they are packed, three in a box, in nickel-alloy carburizing-boxes, using either Q alloy or thermalloy. The approximate size of the carburizing boxes required is 12x44 in., and about 18 in. deep. A liberal amount of carburizing material is provided around each shaft. The boxes are sealed with the regulation cement and are loaded into the carburizing furnaces by a specially constructed charging truck, each furnace-chamber having a capacity of six boxes and each box having a total weight, loaded, of about 800 lb. The carburizing period necessary to get the required depth of penetration is between 22 and 24 hr. The use of nickel-alloy boxes seems to have a decided tendency to reduce the number of hours required to get this penetration.

Machining After Carburizing

At the end of the carburizing process, the shaft is returned to the crankshaft-machining department, where the flange end and the threaded end are machined, roughly, to the finished dimensions, this operation having the result of removing all of the carburized surface. This allows for the machining of these parts after the shaft has been hardened.

The shaft is then returned to the heat-treating department and reheated in a gas-fired furnace to a temperature of 1,420 deg. F. To keep the shaft as nearly straight as possible during the quenching operation, a hinged type of quenching die was devised that permits rapid loading of the shaft as soon as possible after removing it from the furnace. This die is of very heavy construction, and is handled by an air hoist. The shaft is quenched in water at main temperature, and comes from the quenching operation usually not over $\frac{1}{16}$ in. out of straight. It is necessary to straighten the shaft carefully at this point, before proceeding with the semi-finish and finish-grinding operations.

We have found it necessary to divide the finish-grinding operations into semi- and finish-grinding so as to use a rather coarse soft grinding-wheel for the semi-finish grinding in bringing the shaft to the finish-grinding size. The last 0.005 in. of metal is removed from the shaft with a very fine soft wheel to get the required smoothness of finish.

One somewhat uncertain feature that we always meet in the production of this shaft is the amount of shrinkage that will take place in the hardening operation. It is necessary to anticipate this, and to provide for it in machining the soft shaft. Our experience has shown that this shrinkage varies to a considerable degree. Our normal allowance in the overall length of the shaft and the spacing of the bearings is about 0.035 in. for a 5½-in. center-distance between cylinders. We find that this allows us to finish the shaft within the limits required for length, in the majority of cases.

Our scleroscope-hardness requirements of 80 to 100 give us a shaft that has exceptionally long life. I neglected to state, however, that the point of contact of the quenching die with the shaft produces very small soft spots; but they do not seem, as a rule, to interfere with the general durability of the bearing surfaces in any way.

The Franklin connecting-rod is an aluminum-alloy forging, either of duralumin as furnished by the Baush Machine Tool Co. or of 17-S alloy furnished by the Aluminum Co. of America. This aluminum alloy contains the elements given in Table II.

TABLE II—ANALYSIS OF ALUMINUM ALLOY IN THE FRANKLIN CONNECTING-ROD

Constituents	Per Cent
Copper,	3.50
Manganese,	0.20
Magnesium,	0.25
Iron, not more than,	0.75
Silicon, not more than,	0.75

The elastic limit of the forging is between 30,000 and 35,000 lb. per sq.in.; the ultimate-strength is between 50,000 and 55,000 lb per sq.in.; and the elongation is from 15 to 25 per cent.

The forging is heat-treated by heating it to 920 or 940 deg. F., and is quenched in boiling water. It is then allowed to age about one week to bring it to a scleroscope hardness of 90 to 100.

We use about the following procedure in machining the duralumin forged connecting-rod. The forging is first coined under a heavy toggle-press, bringing the length of the wristpin and crankpin ends to within 0.025 in. of the finished size. It is then loaded onto a special fixture on a Blanchard grinding machine that has alternate roughing and finishing stations. It is ground first on one side, then removed from the roughing station, moved to the next adjacent station and finish-ground on the other side. A special multiple-spindle boring and reaming machine having an indexing table is used for boring and reaming the wristpin and crankpin holes. The operations which this machine performs are to rough-drill, rough-ream and semi-finish ream.

The action of the forging in these machining operations is similar to that of mild steel. The power required to drive the drills and reamers is approximately the same as the power we employed formerly with our steel connecting-rod, and the cutting speed does not exceed that for steel by more than 25 per cent. In machining this forging, it surprised us to find that it machined so nearly like a steel rod. We had anticipated being able to machine this rod at a much greater speed than we found possible. The extreme toughness and wire-like quality of the chips are convincing proof that the metal with which we are dealing is something more than ordinary aluminum.

Other Machining Operations

The forging is next drilled for the rod bolts and is then put over a multiple fixture for parting the cap from the rod and facing the seats for the bolts and nuts. A broaching operation follows for providing slots in which the lower-end babbitt blocks are locked. These babbitt blocks are forced into place and broached to their semi-finished size in an ordinary two-spindle broaching-machine. The finishing of the wristpin end of the rod has been rather difficult, because it is impossible to ream a sufficiently good wristpin hole in the bearing end. Our present method of handling this operation is to semi-finish ream this hole, removing about 0.025 to 0.030 in. of the diameter, then to use a final reaming operation that removes about 0.005 in. and a final burnishing operation that is done with a high-speed burnishing-tool under a copious flow of regular medium automobile motor-oil. We find that by leaving a uniform amount of about 0.005 in. on the diameter we can produce a highly burnished surface in the wristpin hole and maintain very uniform size.

However, to obtain the fits required by our engineering department between the wristpin and the connecting-rod, it is necessary to do a certain amount of wristpin selection. When it is finally finished, the alignment of this rod is held to a limit of ± 0.005 in., measured between the ends of arbors 12 in. long.

The finishing to size of the lower end of the rod is left until it is ready for assembly with the crankshaft. This operation is performed on a special type of boring machine in which we use boring bars of five separate diameters, increasing their diameters in steps of 0.00025 in. from the minimum size required up to the maximum; this allows us to cover the entire range in the crank-pin bearings with the proper amount of oil clearance. At this time we use an oil clearance of about 0.001 in. for this bearing.

The weights of the finished connecting-rods run very uniform, it being necessary to maintain but two standards of weight to keep within the limits specified by our engineers, which are a variation in weight of any two connecting-rods on an engine of not more than 0.2 ounce.

Hot-Swaged Rear-Axle Driveshaft

We have been experimenting for the past 18 months with the production of driveshafts by the hot-swaging process but, up to the present, we have not felt justified in following this method of manufacture in large production quantities. The saving in the amount of material used to make a rear-axle driveshaft, together with the reduction in the amount of labor required by this method, make it a very attractive proposition, and we are not at the present time inclined to give up the idea without a struggle.

Troubles have developed in the source of our experiments. We have been unable to obtain a swaging machine heavy enough to withstand the load put upon it by an operation of this kind. We had experienced continued breakdowns of our original machine, and we have practically rebuilt it. The problem of producing a swaged shaft, without having the finished product show any twisting effect whatever from the swaging, has been difficult.

In performing the second swaging operation, which consists of necking the shaft below the diameter of the splined end, we have not been able to reheat for this operation without excessive scaling, which mars the appearance and reduces the strength of the finished shaft. The procedure that we are following at this time requires three separate swaging operations and three separate heats for making them. If it were possible to take the shaft directly from the first swaging operation and bring it up to swaging temperature again, which is about 2,000 deg. F. in our case, and to perform the second or necking operation immediately, we believe we could reduce the amount of twisting and the amount of scaling that we experience at present. The third swaging operation, that of producing the taper and the threaded end, is comparatively simple and gives us no trouble.

We are now considering the installation of a much heavier swaging machine. We find it can be built to order for us. We are considering also the installation of a second furnace to be used as a booster between swaging operations Nos. 1 and 2. With this proposed new equipment, we should be able to produce a very satisfactory product. We would be very glad, however, to learn of the experiences of some of the other automobile companies in producing a hot-swaged rear-axle driveshaft.

Experience Notes from a Production Notebook

By H. J. Crain and J. Brodie
Production Department, Packard Motor Car Co., Detroit

The experiences recorded in this paper have not been selected in accordance with a specific plan. No attempt has been made to cover any particular subject fully or to arrange the different descriptions with regard to a related sequence.

The increasing congestion on city streets and the seriousness of the automobile accident and collision situation should be convincing evidence of the need of proper adjustment of motor-car brakes. It would seem important that cars should be shipped from the factories with the brakes seated and adjusted to overcome the rapid wear that usually occurs in driving the first few hundred miles. This rapid wear is caused by the ironing or smoothing of the brake-lining surface until the high spots have been worn down to the level of the rest of the lining face. It may be due also to slight imperfections in the contour of the brake-band. Two motor-driven machines were designed and built by the Packard company for the purpose of running-in brake-bands, one for the internal or expanding brake and the other for the external or contracting brake. The brake-drums rotate at a speed of approximately 1,000 r.p.m. in both cases. The drums are cooled by water, circulated about the peripheries so that the temperatures are never excessive. Pressure is exerted on the brake-bands by a weighted lever, the weight being adjusted so that the pressure is only great enough to assure a full bearing of the band on the drum. Each band is run for about 1 minute. It will be found that the bands acquire a polished surface on these machines, and that the irregularities sometimes existing around the rivet-holes and throughout the lining surface are smoothed-out. By taking this precaution at the factory the maximum brake efficiency is attained at the beginning of operation of the car, and the adjustments usually required in a new car after a few days of service are unnecessary.

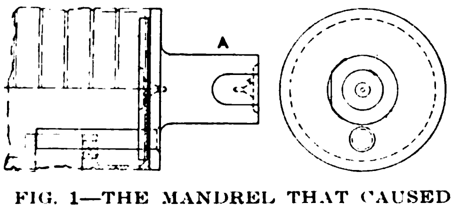


FIG. 1—THE MANDREL THAT CAUSED TROUBLE

The importance of accuracy in grinding a piston skirt is recognized by all production men. The center, shown in Fig. 1, was originally used in the Packard shops for centering and driving the pistons during the external grinding operation. Excessive wear of the surface *A* necessitated the frequent replacement of this center and demanded constant supervision by the foreman in order that the work should not be spoiled by

continuing the use of a center that had passed the permissible stage of wear. The study given to this small puzzling problem resulted in the adoption of the mandrel shown in Fig. 2. The thrust and driving load are taken by a taper-roller bearing of heavy load-capacity, the wear is distributed over a very large surface, lubrication is easily maintained and the life of the center is greatly prolonged. The block *A* drives the piston by

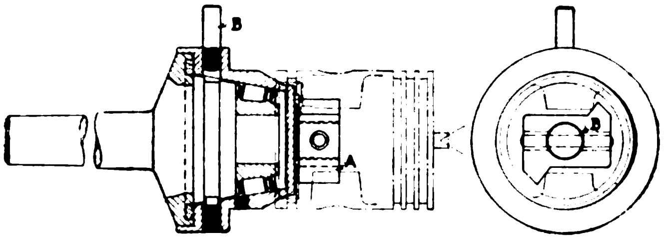


FIG. 2—A ROLLER BEARING PISTON MANDREL

the pin bosses, the block being part of the outer sleeve which is driven by the stud *B*. This design has proved very successful, and, no doubt, other tool designers could apply it to advantage.

All production and inspection departments have had the displeasure of running down peculiar engine knocks. A few years ago when a new model was started through the Packard shops the engines of the first run received at the test-stands were all found to have a perceptible piston slap or knock. Numerous remedies were tried but eventually the real cause of the noise was found largely through accident.

The click came only at the time of the explosion. Investigation revealed the fact that the valves were not centering properly in the conical surface in the cylinder. The condition is shown in exaggerated form in Fig. 3. It was found that the tool used to form the valve-seat was centered by a spindle inserted in the valve-stem guide. This spindle was too much undersize and allowed the tool to float just enough to throw the conical seat out of alignment with the valve-stem guide. As a result, the valve-spring would not bring the valve fully into the seat and the valve would hang on one side of the valve-seat until the explosion snapped the valve into the seat with a very noticeable click. Of course this part of the noise was obviated without difficulty. But this correction did not stop all the noise. A more annoying knock was eventually found to come from the piston-rings, which were of the diagonal-cut type with a slight clearance between the ends. As the explosion-pressure reached the rings they were compressed and their ends snapped. A ring that snaps in the manner described generally shows bright polished ends. When the proper end-clearance had been determined by experiment, the noise ceased. The rings in general use today have overlapping joints, but as the end clearance can be very large this trouble is not encountered.

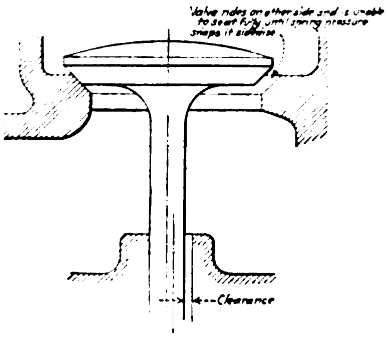


FIG. 3—AN IMPROPERLY CENTERED VALVE THAT WAS NOISY

Oil is circulated in Packard engines by a gear-pump similar to that illustrated in Fig. 4. When this particular design was first adopted it was found to produce a very irritating noise, which sounded like the blades of a fan striking a sheet of paper. Naturally this noise was attributed to imperfections in the gears. In the experiments made to abate this nuisance tooth-forms and pressure-angles were varied, and helical and herringbone gears were fitted, but the clatter persisted. All degrees of backlash were tried but without avail. It was noticed that a certain run of pumps were more quiet than the others. These were inspected carefully to ascertain what variation was responsible for the lessening of the noise. The only difference found was a slight relief on the lower face of the idler gear. At *A* is shown a feeder channel cut in the base of the pump for the purpose of carrying oil to the idler bearing through the cross channel *B*. Note that this channel is open to the pressure side of the pump but ends at the point where tooth contact ceases on the suction side. It was found that when the tooth corners were beveled, as shown at *C*, the noise was reduced. The possible effect of these changes was the basis of a careful study, which resulted in the discovery of the real source of the noise. Both these schemes eliminated the sharp cutting off of the oil stream that would naturally attempt to escape at *D* from the pressure side to the suction side of the pump. By relieving the pressure in the groove *A* the oil was not able to spurt against the tooth faces and rattle the unloaded idler gear in the backlash space in the driving gear. When, as an experiment, the groove *A* was filled with solder, the altered pump became quiet. The design of the pump was changed, the groove *A* was omitted, and no further trouble was experienced. This case is cited as an example because it indicates that gear noises are not always attributable to the gear-teeth themselves.

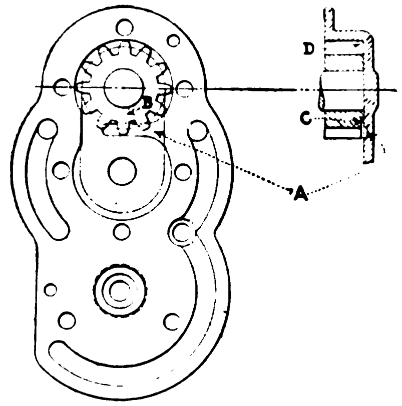


FIG. 4—THE PUMP FOR CIRCULATING LUBRICANT

The production and engineering staffs of the Packard Motor Car Co. have been studying the matter of gear noises for many years. This work is still being carried on but no panacea has been definitely discovered for gear troubles. A large number of investigations made over a period of years have led us to believe that gear noise does not always originate in variations of the gears themselves. Such variations undoubtedly contribute to the gear growl

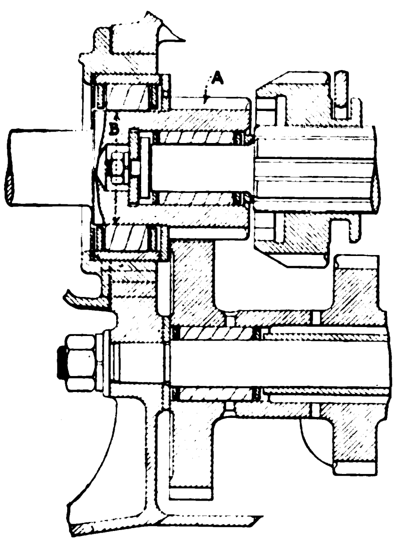


FIG. 5—FRONT END OF TYPICAL TRANSMISSION

or chatter but the noise can often be cured or dampened by an alteration of another part. We have concluded that the proper mounting of the gears on rigid shafts is a paramount requirement if noise is to be avoided. The most perfect tooth-forms, ground, shaped or milled, will not run quietly if they are carried on shafts that spring or are not in alignment.

The front end of a typical transmission is shown in Fog. 5. Particular attention is directed to the mounting of the main drive-gear *A* in which it will be seen that this is carried on a roller bearing, the inner race of which is formed by the shaft itself and the outer race is mounted in the transmission case. In the final inspection of a certain model at the Packard factory it was noticed that the degree of gear noise varied from very quiet to objectionably loud. Attention, naturally, was centered on the noisy gears. These were returned to the transmission department and torn down for careful inspection, adjustment and reassembling. Invariably the inspection revealed gears, bearings and shafts that were as near perfection as it seemed possible to approach. This led to the assembling of special gears in which perfection was carried to the utmost degree, a state far beyond that possible under even unreasonable inspection practice. But the noise, if anything, was worse.

Locating the Trouble

It remained for us to tear down and inspect several transmissions that were passed in the final car-test as being quiet. When this was done it was found that the roller race on the shafts had been ground to low-limit diameter, while the roller race in the shells had invariably been ground to the largest or extreme high limit specified for these holes. For purposes of comparison, six noisy transmissions were then torn down, the bearing diameter *B* was ground approximately 0.001 in. under the former low limit and the transmissions were reassembled and tested. This change caused the noise practically to disappear.

Experiments were made repeatedly with noisy transmissions and, in every case, when this alteration was made and the bearing clearance was increased, the noise was either entirely eliminated or reduced to a degree that was not objectionable. We concluded that this result was produced by providing sufficient space for an adequate oil-film. Further experiments along similar lines have substantiated this conclusion.

Providing the Remedy

The remedy seemed a simple one to apply but we were quite concerned about mounting a bearing under conditions that simulated those it would assume after several months' wear. We had always supposed that bearings of the anti-friction type must be mounted snugly. Before definitely adopting the new practice, wisdom demanded that we check the effect of the greater diametral clearance on the wear of the bearing. Transmissions were run under similar conditions with the standard or snug bearing and with the increased clearance. We found that the snug bearing wore rapidly during the early stages of the test and eventually reached the state of looseness with which the other bearings started. The loose bearing, on the contrary, practically retained its original clearance. We concluded that the wear of the snug bearing was accelerated because of the absence of an oil-film sufficient for complete lubrication. The loose bearing apparently accumulated an adequate oil-film and the wear was normal. The test was continued for some time and frequent examinations showed that the snug or full-fitting bearing continued to wear faster than the loose one. This, we believe, is due to the heavy initial wear that breaks or distorts the ground surface instead of glazing it as seems to be the case when the bearing is assembled with a proper clearance at the start.

After the transmissions using the roller bearings had been changed to conform to the practice just described, it became apparent that the same gear-noise existed in the transmission used in one of the other Packard models which had the transmission gears mounted on

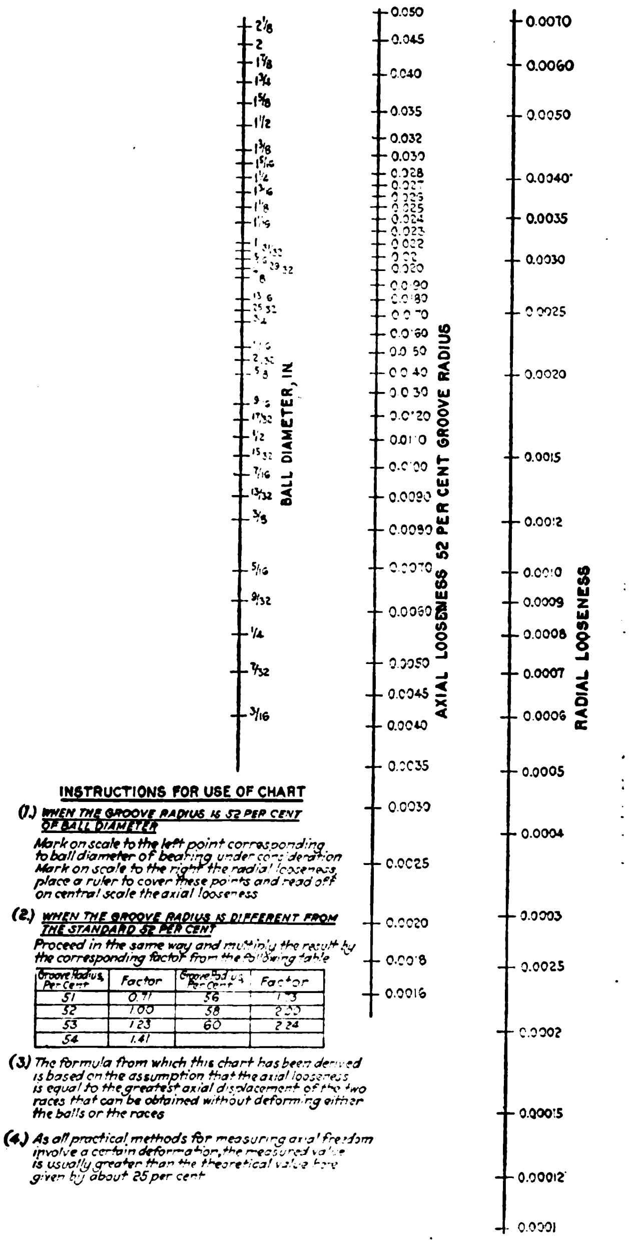


FIG. 6—CHART FOR BALL BEARING CLEARANCE

ball bearings. We altered a few experimental ball-bearings by deepening the grooves in the races to allow a minute clearance for the balls, instead of assembling them to a good rolling-fit or to the fit of the standard stock. This was done to provide oil clearance, as had been done with the roller bearings. When the loose ball-bearings were substituted for the tight ones in noisy transmissions, our previous experience was repeated and the noise decreased.

It was a comparatively easy matter to determine the

clearance needed in the case of the roller bearings since diametral clearances could readily be measured. It was found to be difficult, however, to measure radial clearance in the ball-bearing races and we were forced temporarily to determine the degree of clearance by the end-play or axial looseness. A maker of ball bearings prepared the chart, reproduced in Fig. 6, for the purpose of converting a desired radial clearance into the equivalent axial play. This enabled us to order bearings with a selected radial clearance, which could be held uniform without demanding a finer tolerance from the bearing maker, and cured the gear noise most effectively.

Backlash and Noise

From the two cases cited we judged that the same reasoning might apply in determining the proper allowable backlash in gear-teeth. Here, again, there is a possibility of not providing sufficient room for a film of lubricant, of squeezing all the oil out of the meshing space, and of causing increased noise. Experiments with gears identical in every respect, except in the amount of backlash showed, that a very evident drop in the noise of the gears was produced when the backlash was increased to a certain point.

It has been our experience that whenever you silence one noise in a car, another becomes evident that never caused complaint before. The eventual attainment of silence is the result of a persistent noise-curing campaign which starts with the noise that is most noticeable and works down the line. This method has resulted in finding that the rear-axle noise still persists in most cars though in a much less disagreeable degree.

The spiral bevel-gear, originally introduced by the Packard company, was a big step in the direction of reducing rear-axle gear-noise. Until other units of the automobile had been perfected to their present state of quietness, we were satisfied that rear axles were about as quiet as they could be made commercially. We are now endeavoring to perfect the assembling of the gear units, so that the noise caused by their operation shall be reduced to the smallest possible degree.

Selection of Machine Tools

By A. J. Baker
Production Department, Willys-Overland Co., Toledo, Ohio

A PRIMARY consideration that an executive must give to any purchase, be it design, material or equipment, must of course be its suitability for the purpose intended; another is the availability of a source of supply.

The machine-tool builder, who looks toward a full utilization of his plant, will use all his engineering ability to develop some new machine, the output of which shall be so great that it will relegate to the discard all the machines previously made by him, even though they may have been so well constructed and so well used that their productive life is still a matter of several years. He will do this on the theory that you cannot afford to be without the newer machine because of the marked increase in production of the newer tool.

Those of us who select the machinery must bear in mind the type of help that will operate it. Machines that call for adjusting by hand during their operation, for accurate reading of dials or indicators, for careful setting up of the work in the machine, for a complex cycle of operations involving a developed mentality; all are to be decried; for not only do such machines limit the number of operators available, but under the stress of production, the amount of scrap that the machines will produce is always entirely out of proportion to that produced by simpler equipment.

The Special Machine

A natural development of the above line of thought leads us to the special machine. By this I do not mean the single-purpose machine, or, better still, the single-piece machine. There is a marked difference here which must not be lost sight of and our failure as an industry to keep this difference clearly before us has led to the adoption and use of some machines that cannot be regarded as wholly satisfactory from an economic standpoint.

Between the single-piece machine and the standard machine tool is the safe position. Some machine-tool builders already have recognized, and there is no doubt that others will recognize, the special needs of the automobile business. They have produced machine tools in which the feeds and speeds cannot be changed at the will of the operator, but can be changed at the will of the executive by the transposition of gears. These machines permit adjustments but only by the set-up man. They are constructed liberally along the lines of spindles, slides, gearing pulleys, and the like, and preferably are over designed for the power that they will consume. They are lubricated fully and automatically and do not require the use of the oil can. In the hands of the operator they are only single-piece machines and as such may be designed with a reserve of power and a rigidity much in excess of the more universal type of machine, because their application is not so constrained, and they can be regarded as a perpetual asset even though the model, or some detail of a model were discarded and another took its place.

Why New Machines Are Bought

We now come to the reasons for purchasing new equipment or new machines. The one most frequently encountered is that the new machine will save money. It is not always expressed that way. It is sometimes argued that the new machine will reduce the labor cost or will turn out a piece more quickly than under the old method; but these are not the real things to be considered. The only satisfactory reason is to reduce the cost and not to reduce the labor charge or increase the production per man, and in this cost reduction appears the consideration of the items that I have already touched on. The second reason is to increase production; in other words, to turn out more parts per year or per season. In this case the consideration will be whether to put in more machines of the type already in use, or to purchase some machine that was an improvement but of the same general type, or to get an entirely new kind of machine.

There is much to be said for maintenance standards. If the records show that the tool you have been using is up to the average in productivity, it would be foolish to change to another make, even if a somewhat greater

output could be shown. Unfortunately many machine tools of the same general classification differ so much in detail that the equipment of one cannot be transferred to another. The T-slots in tables, the taper hole in spindles, the thread on spindles, the form of tool-holder, the method of clamping the tools, the arrangement of the control levers all differ very widely. You are therefore forced to make up special fixtures, which differ in some details from those you have been using on other machines. This means that if a breakdown occurs, and if you have planned for it and have extra tools available, you will have had to carry just twice as many fixtures in excess of actual requirements. If you have more than one make of machine you will not have the facility of immediate interchangeability. You will not with any degree of certainty, be able to transfer the operators. The foremen will spend much more time in the instruction of the men. The time-study department will have to make changes in the times, because the speeds and feeds may differ somewhat, and it may mean that the rates set on the job and used successfully will have to be readjusted.

In summarizing, I want to make these points:

1—There is a surplus of machine-tool equipment of the standard types both actual and potential.

2—Machine-tool makers are devoting their thought to high-production single-purpose machines of standard types.

3—The craze for special machinery is passing.

4—Special machinery will not always stand a financial comparison with standard machinery.

5—We are not, as an industry, facing our responsibilities in the matter of training operative help for tool and die work.

6—When considering new equipment we cannot disregard the inventory value of existing equipment and the loss that would be shown on our balance sheet if the existing equipment were converted from productive machinery into excess machinery for sale.

7—The only good reason for installing new machinery, old machinery or any machinery, apart from those cases where a better quality is demanded, is to reduce the cost of production.

Processing Spline Shafts by a New Method

By James A. Ford
Production Department, Studebaker Corporation of America

THE general practice among manufacturers of transmissions requiring a spline shaft has been, for many years, to finish the spline and body portions of the shaft by grinding with a formed wheel after hardening; but it has been found that this process necessitates frequent dressings of the grinding wheel and demands extreme care in the obtaining and maintaining of the desired form.

Since it was desirable that these difficulties be eliminated, it was decided by the corporation of which I am a representative that the best method would be to omit the grinding operation and substitute a process that would not include these grinding troubles. Experiments along this line consequently were carried through by the methods and standardization department of our corporation, and the results of its investigation are presented briefly as follows:

The accuracy of the finished shaft is the primary thought that was borne in mind during the investigation, and the other important points considered were that the

(1) Splines must be straight, in line with the axis of the shaft, uniform in width, properly spaced and smooth on the wearing portion

(2) Body of the shaft between the splines must be round and parallel with the axis of the shaft, the diameters must be held within prescribed limits at any given portion and the surface must be smooth

(3) Entire shaft must be true in relation to its axis, of the proper degree of hardness and made of the best obtainable material for the purpose, without regard to any difficulties that this requirement may introduce into machining operations.

It was evident that other troubles would appear after departure from the grinding troubles that were experienced in the finishing of the shaft by the old process. The troubles that were anticipated were as follows:

(1) Difficulty in hobbing to exact dimensions, obtaining a smooth, even surface and maintaining a true form

(2) Liability of warpage in shafts during the process of hardening

(3) Variation in diameter due to hardening

(4) Variation in the width of the splines because of hardening

It was believed that a given allowance could be made

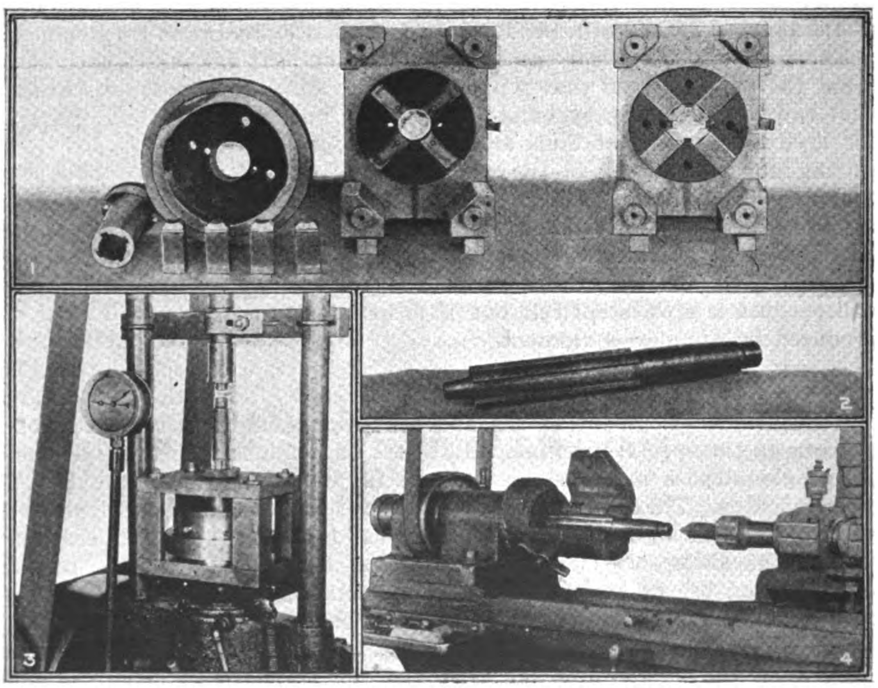


FIG. 1—THE DIE FOR SHAVING. FIG. 2—A FINISHED SHAFT. FIG. 3—HOW THE SHAFT IS FORCED THROUGH THE SHAVING DIE. FIG. 4—RE-CENTERING BY GRINDING

for shrinkage during the hardening process and that a uniform shape and size could be determined in advance. Therefore, to overcome difficulty (1), the decision was made to draw the shaft through a die after the shaft had been carbonized. It was found possible to do this by using the methods and tools that will now be described and illustrated.

The die shown in Fig. 1 is constructed according to the same principles that apply to the automatic threading-dies now in general usage, the cutters being in the position that the die chasers ordinarily would occupy. At the right cutters are shown installed in the die. The cam ring is practically of the same construction as that used on a threading die, except that the ring is made stronger. The opening feature is necessary on account of having to pass the shaft back through the die, because the body of the shaft beyond the splines is larger than the body-portion between the splines and the shaft will not pass completely through the die. This is illustrated clearly by the view of the shaft shown in Fig. 2.

The shaft is entered into a bushing that is lined-up with the die. Then the shaft is pressed through the die to a stop that has been set at a sufficient distance to permit the shaft to pass through to the shaft-neck at the end of the splines, as illustrated by Fig. 3. The cutters in the die are then released and the shaft is removed.

During the experiments with this die, it was ascertained that a clearance angle on the cutter of 30 min. was about correct, and it was decided that one pass of the shaft through the die gave the best result.

Up to this point we had a shaft that was carbonized, and its body and splines were finished to the dimensions desired. After hardening a number of shafts, we were able to determine just what change took place in them, and an allowance was made for this in the adjustment of the die. The change was uniform to a reasonable degree in all shafts, and the existence of this uniformity enabled us to determine very closely what the standard allowance should be.

The next problem was that of overcoming the warpage in a shaft after it had been hardened. Fortunately, we found that this warpage was outside of the splined portion of the shaft.

Straightening the Shaft

It was very difficult to revolve the shaft on its centers and straighten it to the degree of exactness required, and the operation required too much time. However, we found it possible to straighten the shafts easily to within 0.005 in. per ft. of being out of parallel with the true axis of the shaft. Therefore, we straightened the shafts to within the 0.005-in. per ft. limit.

After having been hardened and straightened to within the 0.005-in. per ft. limit, the shaft is gripped in a fixture mounted on the spindle of an internal-grinding machine as illustrated in Fig. 4. It is then revolved true with the splines while it is being re-centered by grinding against the pencil-shaped grinding-tool shown also in Fig. 4.

After the new centers have been established true with the spline portion of the shaft, the remainder of the operations follow ordinary shop practice.

The Group-Bonus Wage-Incentive Plan

By E. Karl Wennerlund
Production Department, General Motors Corporation, Detroit

The subject of wage incentive is an important one to factory executives. During the past few years it has received considerable study. Nearly all factories now have their own specialists who make time-studies of operations and recommend or set production rates. Even where outside industrial engineers are employed for this purpose their services are regarded as temporary, with the idea of developing a local staff as rapidly as possible to handle the regular routine. The question of the particular form of wage incentive, therefore, becomes important. No single plan can be recommended for all factories. Local conditions and the character of product will have to govern in each case.

Until recently, the plan followed has been generally of the type known as the individual-effort plan, with either straight piece-rates or some form of premium or bonus based on time measurements. Grouping of employes was not often resorted to, except for such operations as made it impracticable to keep track of the output from individuals.

Simplifying Factory Routine

It was the desire to simplify the factory routine, and to escape from this mass of detail management without sacrificing the principles of quantity checks, that prompted the development of the group-bonus plan.

Under the group plan it would not make much difference in theory whether a fixed group-price were established or some form of bonus or premium payment were used. On the other hand, a fixed group-price in money value would offer some very definite objections if adopted as a general plan.

To obtain a clear idea of the application of group standard-time and its use as a basis for a wage-incentive plan, let us consider a single production line manufacturing and assembling pistons in an automobile-engine plant. This unit has its operations arranged in sequence, in what is known as a progressive line of manufacture. It starts with the rough-machining of the casting and ends with the finished product with piston-rings inserted. The production line includes both machine and bench-assembly operations. Parts move without a break from one operation to the next in a steady flow. Some operations may be done by a single workman, while others may have several workers in parallel, depending on the volume of production and with what detail it is practicable to subdivide operations.

It is proposed to keep no check on quantities passing intermediate operations or on those completed by individual workers on operations in parallel, but to give credit for finished pistons passing final inspection. This particular production line may be located in a department also producing connecting-rods or any other line of manufacture. Such a line embraces a production unit of the factory, and is technically known under the group plan as a *division*. Its workers are primarily interested in the production of pistons but they know little or nothing about conditions on the connecting-rod line and should not be grouped with it.

Each member of a group receives the same percentage

of bonus at the end of the pay period, but it is computed on his wage earned while assigned to the group and the total amount earned by each worker will, therefore, depend on his hourly base-rate and number of hour worked. No job tickets are used. A shop timekeeper will handle from 300 to as high as 600 group workers. A list of employes is tabulated daily for each group, and elapsed time is taken at the end of the day from the entrance time-clock. If a worker is transferred out of or into a group, a transfer slip noting the time is recorded by the timekeeper and the elapsed hours are charged accordingly. Standard-hours credit is obtained from the finished inspection reports of quantities, multiplied by the group standard-time.

A group may produce various parts having different time-standards, and therefore different direct-labor costs and, since we use no individual elapsed-time job-tickets, labor costs are computed from the group cost per standard-hour. For given base-rates, the labor cost will be constant per standard-hour and per piece for all efficiencies above 100 per cent. If the average efficiency falls to 90 per cent, the labor cost will increase less than 2 per cent.

Grouping Indirect Labor

Indirect labor has been grouped extensively wherever a "community of interest" can be maintained between workers. They must have a common interest in the results of their own efforts. Storeroom labor, unloading materials from car, boxing and loading automobiles, for shipment and similar classes of work where the effort is measurable, have been grouped with very good results.

In summarizing our experience during the past four years with the group-bonus plan, it should be borne in mind that the particular feature involved is the principle of grouping employes and not the wage-incentive table that happened to be selected. Very likely any one of several incentive plans could have been used in connection with grouping and have produced satisfactory results. This one was selected because we thought it would be more adaptable to changing factory conditions than a system of fixed-group piece-rates having their value in dollars rather than in time. It also offers the same incentive to high production as could be obtained from piece rates.

Advantages of Grouping in Operation

Although the primary purpose of grouping was to simplify the factory system and to reduce the amount of clerical detail, it developed that there were many advantages from an operating standpoint. Much less material is tied-up in process, and full advantage can be taken of the mechanical arrangement of progressive lines whereby parts are made to flow from one operation to the next in a steady stream through single or parallel operations. Under the continuous-flow method of production, the checking of quantities after individual operations becomes difficult, if not impracticable; so, the logical method seems to be to count from the end of the line and credit groups of workers. Nearly every such production line has its "neck of the bottle" or several of them. If these can be speeded up, the whole line benefits.

One of the early advantages noted was the speeding-up, or elimination, of slow workers. Hence, it has been our experience that more production per man-hour has been obtained under grouping than under a previous individual-incentive plan. From the viewpoint of factory operation it has meant the elimination of job tickets and elapsed-time records for group operations. This has meant saving in clerical detail. It has added to productive time, because there are always some delays if employes are required to keep count on quantities, obtain job tickets or furnish information to shop checkers.

Standard Versus Special Machine-Tools for Automotive Production

By R. K. Mitchell
Maxwell Motor Co., Inc., Detroit

THIS PAPER is not an attempt to dictate a set rule or policy for the tool engineer or tool designer to follow in every problem that presents itself. Rather, it is a general criticism in disfavor of the present prevailing policy of making large expenditures for special equipment when standard equipment might well serve the purpose, and also a plea for the reduction of the altogether too large investment carried under fixtures and permanent tools.

There was a time when the automotive manufacturer found it necessary to build special machines for performing certain operations and making special parts. When an operation or a part of that description was required, the policy was to design special fixtures and machine tools to meet the special conditions. But often when the original intention is only to design a special fixture, the ultimate result is a fixture or machine tool that requires special driving and feed mechanisms. Then comes the question of whether or not to design special drives and feeds for some machine that is already in the plant, and this is the critical point in the argument between special tools and standard equipment. In many instances the only machine tool that will accommodate the special heads is a machine tool designed and built purposely to meet this one particular difficulty; so, we arrive, perhaps unintentionally, at the stage we have so much desired to avoid, which is the design and fabrication of special machine-tools.

In the ordinary routine followed when building special machine-tools, we are confronted with numerous obstacles. The first is the fact that the average draftsman found in the general run of tool-designing departments has had neither the engineering nor the production experience essential to the proper designing of special machine-tools, and his lack of knowledge as to proper stresses, correct bearings, loads and the details to be employed, together with lack of foresight in considering the interchangeability of parts, ease of replacement and the use, so far as possible, of standard parts, is reflected in the enormous first cost of the majority of special machine-tools that are built under private supervision. The actual construction usually is performed in the tool room by high-priced labor, working an excessive amount of overtime, and the machine, finally completed,

has yet to meet its first test. It will be acknowledged that very few special machines have ever been devised and built that did not demand much undue expense and delay in production, not to mention the many changes made before they began to function as originally intended.

A special machine-tool for turning both sides of the flange and the face of a flywheel at one operation was designed and constructed recently at an expense of $18,000 to $20,000. Three days after the machines were installed, they were abandoned; but, fortunately for the manufacturer, the old set-up was still available. This was not because the old set-up was more efficient; but because, although there was every opportunity to devolop a machine that would give greater production, lack of foresight and poor design ruined the whole project. The worst blunder was that no provision had been made or could be made for the escape of chips. Chips from the upper cutters worked down and packed against the bottom face, impeding the two lower cutters and necessitating their removal with a chisel about every 10 min. The final outcome of this case was that the manufacturer had to go out in the market and buy standard machine-tools. If the outlay wasted in design and construction on the special equipment had been applied to the purchase of standard equipment, it would have more than covered the standard machine-tools that were afterward purchased. The result of the whole incident was that $35,000 to $40,000 was expended, where $15,000 would have served the purpose.

Disadvantages of Special Machines

A special machine-tool in production requires the services of a skilled or special operator, at least until those interested have become familiar with its care and operation. If the operator should be absent for any reason, loss of time and production must result before another man can be broken in.

Repair parts for special machine-tools are costly items. It develops not infrequently that patterns are broken, mislaid or left at the foundry and, when the casting is finally secured, it means day-and-night work in the tool room with additional expense and delay.

The most forceful argument against special machine-tools at present is the unstable design and development of automotive parts. When a designer produces a special machine-tool to accommodate a certain part, he has no guarantee as to the life of that part and, I venture to say, the average life of the majority of automotive parts, without change in design is less than 6 months.

Let us consider now some of the advantages of using standard equipment and machine tools. To-day, machine-tool bnilders have stocked the market with a large variety of simplified, standard machinery that can be adapted to special operations and parts with slight extra expense. In the first place, the standard machine-tool is very much cheaper than a special machine. It is built on a quantity-production basis, and designing and engineering charges are distributed over a greater number of units. The standard machine-tool is available for prompt delivery. It has had a thorough trial in practical work before being placed on the market, and is out of the experimental stage. Reputable manufacturers of standard machinery build their machine tools so that the parts are interchangeable and, in case of service requirements, they are prepared to furnish any part promptly from stock. Consider for a moment the money that is tied up in special machinery patterns, extra castings and the like. With a standard machine-tool in production in any large shop. if an operator is called from his machine, other men just as familiar with the operation of the machine are always available.

I believe there is ample room for improvement in the design of special fixtures. Too little attention is paid to the needs of manufacturers of standard parts whose product, if properly investigated, will be found to contain unlimited possibilities for incorporation in the design of special jigs and fixtures. In a recent issue of a popular weekly periodical. there was a full page spread. advertising the merits and possibilities of standard bushings. This advertisement alone probably meant an expenditure of $8,000 or $10,000 for that manufacturer. With dozens of companies just like this that place their engineering staffs and experience in their particular line at our disposal, still we do not pay enough attention to their claims and the merits of their products to consider them when designing our own pet tools and equipment.

So far as possible, when designing fixtures and tools, we should take advantage of all that the trade offers, and attempt to simplify our creations. The frequent use of the three fundamentals of jig and fixture work, the clamp, the V-block and the angle plate, is to be recommended.

As a recent instance, a large drum-type fixture was designed, built and installed on a machine. The cost was about $2,500, including special drive gears and the like that were constantly breaking, delaying production and running up a continuous repair bill on this job. The annoyance and continuous expense demanded immediate action and the whole fixture was replaced by two small angle-plate fixtures on which V-blocks to oppose each other were fastened. One side was loaded while the part on the other side of the fixture was being milled. These two fixtures cost about $70 and actually increased production beyond that of the more elaborate and expensive fixture. This is only one of similar instances that occur every day. I believe that the tool designer is so prone to become interested and intent on the design and construction of the fixture that he temporarily loses sight of the fact that the fixture or tool is not the ultimate issue, but only the means to an end.

The Control of Operating Tool and Supply Costs

By F. A. Mance
Production Department, Studebaker Corporation of America

A CONTROL OVER expenditures for perishable tools and operating supplies has been successfully established by rating or allotting the amounts to be used by each department for every operation. By this allotment we are able to regulate the amounts of tools and supplies used throughout the factories in accordance with the number of cars built. Each item is priced and extended, and the aggregate is totaled. The total represents the amount of money allotted to the department to produce a definite number of cars in a given period of time. In figuring departmental percentages of efficiency this amount is included with labor and production.

This system has been in operation for nearly four years and during this time the cost of renewals of perishable tools has decreased approximately 71 per cent,

though some of this reduction was due to a decrease in the cost of the tools.

To anyone interested in adopting this method we would suggest the following procedure: Start with the selection of a competent and aggressive tool-trouble man for making the survey. Provide work sheets on which to list the department, the part number, the operation, the description of both tools and supplies and the amounts allotted for any given number of cars per month. These work-sheets are afterward to be used in making up a standard form in quadruplicate. The standard form should contain additional information as to price, the extensions and the total, as previously explained. The standard allotment-sheets when completed are distributed to the foremen interested, the tool or supply stores, the superintendent of the plant and the supervisor of tools or the methods and standardization department.

Deliveries from stores are made upon approved requisitons, provided the article wanted has been previously allotted and appears on the allotment sheets. Departmental operating tool and supply reports are made up for every 10-day period by the supervisor of stores and show the amounts withdrawn during that period. They are then forwarded to the accounting department for pricing. From copies of these sheets each foreman is checked as to the amount he is running over or under his allotment and he is allowed to see these copies during each period in order to acquaint himself with the cost of the article that he uses.

Salvaged or restored tools are carried in stock and are given out on requisiton in the same manner as new tools, with the exception that the requisition is stamped with the word "salvage" in red ink. This signifies that there is to be no charge against the department drawing out this material. When a drill has become too short for use in one department it is turned in as "salvage" and reconditioned for use in another department. This is also done with cutters, reamers and grinding wheels. The allotment sheets show where the salvage should be used and each item so salvaged is listed "no charge."

The tool-salvage department keeps in touch daily with the various department foremen, advising them of available salvage tools especially when these are in addition to the tools specified on the allotment sheets. The use of salvage tools so far this year has amounted to $1 per car. This sum represents what the cost would have been had we purchased new tools. The amount of money spent to recondition the tools amounted to 30 per cent of the original cost. This 30 per cent is charged off as expense, and is pro-rated over the entire portion of the plant that is benefited by the use of the tools.

One important factor that has a direct bearing on tool cost is the listing of sources of supply. This list is made up by the methods and standardization department and contains the names of the firms whose tools have given us the best results in actual use over a period of from one to four years.

Selling Machine Tools

By Entropy

Taking the machine tool business of the country as a whole it does not seem likely that the amount of the total domestic sales is at all affected by advertising, salesmen's trips, or any kind of selling campaigns. What does happen is that of the total business available, more goes to the firms that advertise continuously and follow up their inquiries by personal interviews than to the firms that trust to luck that their share of the business will fall into their laps.

However, the purchaser pays for all this. He pays for the privilege of being solicited by a dozen representatives of different machine shops and it all comes in the bill for whatever he does buy. The point of this is that if customers make it expensive for firms to sell them their equipment, they simply add to a burden something which does no one any good. The customer who writes to every firm that advertises engine lathes, saying that he is in the market for one 18 in. x 8 ft. lathe and that he desires full information regarding it, and then asks that a representative be sent to see him, or what is the same thing, strings along the firm so that they think he is a likely prospect, adds to a total that is already bad enough.

There are a few points on which a customer needs information, he needs to know about the design, the workmanship, the materials, and price and delivery. Most advertisements are unenlightening on all these points. They tell us that the design is superior, the workmanship is workmanlike, the materials are the best in the market, and they suggest we write and ask the price, and whether deliveries are being made now or next year. In the old days of advertising when an ad was a permanent thing not changed from year to year, to say nothing of issue to issue, this was all right, but in these days it is possible to say how superior the design is, not merely that the main bearings have now been made a thirty-second of an inch larger than they were in 1910, but tell why the machine is an improvement on all other, or "garden varieties" of machines. Then workmanship can really be described.

For some purposes a lathe made interchangeable by means of fairly liberal tolerances in the sizes of the parts is good enough, but for our shop of course nothing will do but the finest of all hand-fitted work. Interchangability is all very well if we break a part, but we do not intend to break any parts, and we know that a truly high-grade machine must be hand fitted, part by part. Of course we are glad to know that the legs are drilled in jigs so that if the railroad in its anxiety to make quick delivery breaks one we can get another, but we want all the running parts to fit alike so that we can oil up with a fairly liquid oil and not have any shake in the fits. We want to know what the builder thinks are the finest possible materials. Is the main bearing made of cast iron, babbitt, or, if bronze, of what composition? Are the lead and cross-feed screws made of something in particular or of any stock the boy happened to find on the floor?

Of course it is entirely heretical to suggest any one marking the price of a machine tool in plain figures. To be sure the lathe builder travels to and from work in a machine the price of which, f.o.b. Detroit, is $298.00, which price is as well known as the name of the car itself, but if he should mark one of his lathes $984.50, the chances are he would be read out of the Machine Tool Builders' Association. Of course it would be still worse for him to advertise a line of 24-inch lathes and say, "We are now booked up to April. If you want May delivery order now." It might pay, and anything that makes the machine tool business a paying business should be frowned on.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

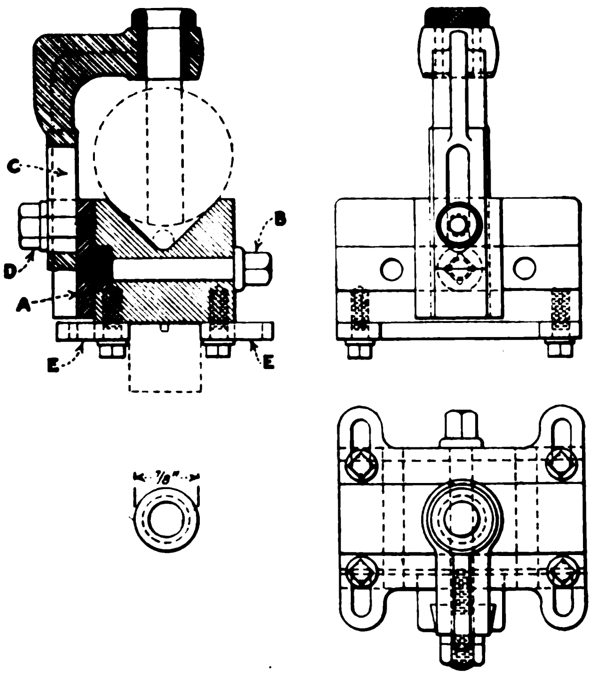
An Adjustable Drill Jig for Round Stock

BY B. R. WICKES

The accompanying drawing shows an adjustable drill jig that is very serviceable in the shop where there is much drilling to be done upon round pieces. By reason of its adjustability it is adaptable to any size of round stock within its range. It will also hold half-rounds, squares or tapers.

The body consists of a V-block, in the side of which is milled a shallow rectangular shaped groove parallel to the V on the upper surface. Part *A* is tongued to fit this groove and is held in position by the long bolt *B*, passing clear through the block. Three (or more if desired) holes through the block permit the bushing bracket to be set at different positions with respect to the length of the block.

At a right angle to the tongue and on the opposite side of part *A* is an open dovetailed slot, fitted to receive the corresponding portion of the bushing bracket *C*, which is clamped to it by means of the shorter bolt *D*. A slot in *C* allows the setting of the bushing bracket at



ADJUSTABLE DRILLING JIG

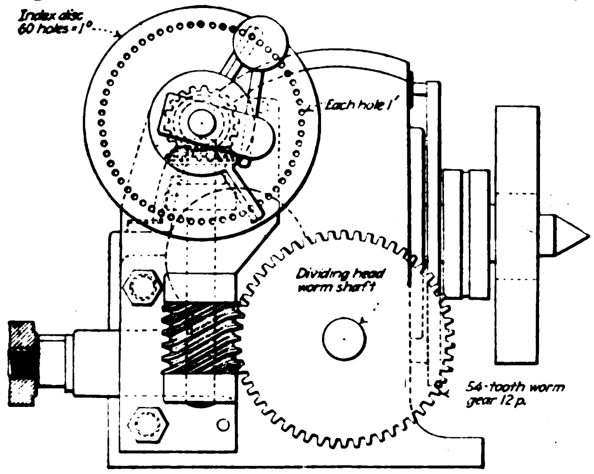
varying heights to accommodate different sizes of work. The bracket may also be turned end for end and the device used the other side up, the work in this case being held by the jaws *E*, which are adjustably attached to the under surface of the block by the small collar head screws. The tops of these screws should be ground off after they are in position and set up tight, as they act as feet upon which the device rests in normal position.

Attachment for Indexing Degrees and Minutes

BY EDWARD J. RANTSCH

The accompanying drawing shows an attachment for universal dividing heads, the purpose of which is to make possible the indexing of degrees and minutes.

Referring to the blueprint, it will be noted that a wormgear has been substituted for the usual index plate



ATTACHMENT TO DIVIDING HEAD FOR INDEXING TO ONE MINUTE OF ARC

and securely fastened to the regular worm shaft. Meshing into this worm gear is a sextuple threaded worm assembled on a bracket and driven by a pair of miter gears. The special index plate contains 60 holes, and is securely fastened to the bracket. The usual index crank handle is used as before, provision having been made to receive it. The complete bracket is held in position by two hex-head capscrews and two dowel pins.

In indexing, one turn of the crank handle equals one degree, and one hole equals one minute. It is necessary to turn the crank handle 360 times to make one revolution of the work. This means that the spindle moves one-ninth as fast as with the original gearing.

Let us say we wish to index the work through an arc of 39 min. As one hole on the plate equals 1 min., we index 39 holes for 39 min. Now take 25 deg. 19 min. As one turn equals 1 deg., we index 25 turns, and add the nineteen holes for the 19 minutes.

One of the jobs that this attachment is useful for is work requiring unequal indexings, such as the graduating of master gages used in checking and inspecting the time-fuse rings of shells. The graduations on the rings all vary, or in other words, are not equally spaced, and the writer well remembers the difficulty experienced in trying to get two master gages to agree.

The attachment can also be used on any tool, jig or fixture work where boring holes to angular measurements is required, as the indexings are so fine that it is possible to get within very close limits.

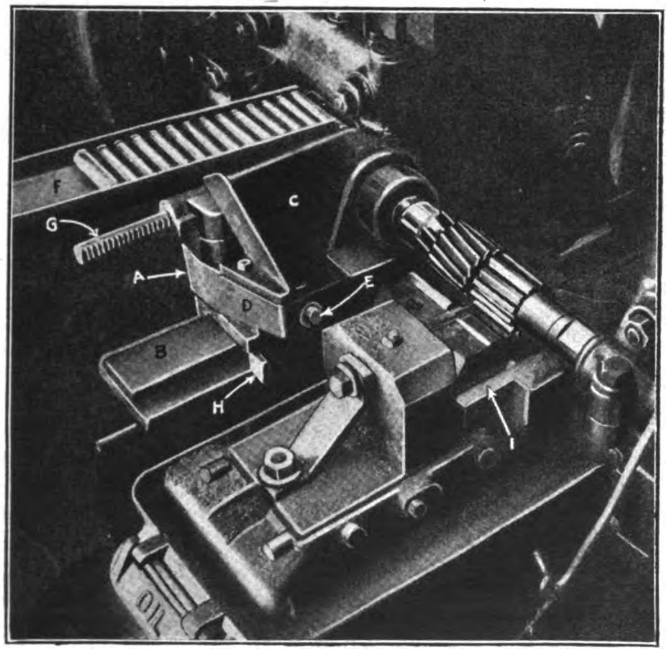
P. & W. Semi-Automatic Milling Machine Becomes Full Automatic

By Ellsworth Sheldon

By an ingenious attachment, a Pratt & Whitney semi-automatic milling machine in the shops of the Lovejoy Tool Co., Springfield, Vt., has been converted into a full-automatic machine, requiring no attention from the operator other than to fill up the hopper occasionally—and no harm done if he should happen to forget it. Mr. Lovejoy himself is sponsor for the device.

The work done by the machine is the flatting off and serrating of one side of round pieces of high-speed steel that are to become the cutting points of the Lovejoy company's inserted-tooth products. The machine is well known to all who have much to do with production work. The attachments that make it full automatic are the hopper and feeding device, and the self-opening and closing vise.

The feeding device, shown at *A* in the accompanying illustration, is fitted to slide freely upon the dovetailed guide-way *B*, lying beside and parallel to the main table of the machine. This guide way is bolted to the frame of the milling machine and has no movement. The device is normally held against a positive stop in the position shown in the cut by a stiff coil spring; but at certain times in each cycle it moves outward to the end of the guide-way.



AUTOMATIC FEEDING DEVICE ON P. & W. SEMI-AUTOMATIC MILLING MACHINE

The hopper is in two parts. The triangular shaped casting *C* was first devised to hold a number of the pieces to be milled and the cavity was intended to be filled with the work. In the casting *D* there is a cradle just large enough to accommodate one of the pieces which, when lying in the cradle, will be in line with a bushed hole through which it may be pushed endwise out of the device. At *E* may be seen one of the pieces protruding slightly from the bushing; this piece, however, is not in normal position but was pushed part way out to show its location in the photograph.

Because of the tendency of the work pieces to jam and "hang up" in the triangular cavity of the original hopper, the sheet metal part *F* was added, the leg of which extends down into the cavity and closes off a portion of it so that now there is but a single stack of work pieces within the original hopper. The upper part of *F* is sufficiently inclined to cause the round pieces to roll forward against a stop, where the last piece in line rests on top of the vertical stack, ready to follow down as the pieces are successively pushed out from the bottom.

The transverse hole in part *D* passes clear through, the cradle, of course, forming the central portion of it. A round plunger, or pusher, slightly smaller in diameter than the work pieces, fills this hole when the device is at rest; but during the feeding movement it is withdrawn by a rack and pinion to allow the lowest piece of work in the stack (that up to this time has been resting upon the pusher) to fall into the cradle. As the device returns to its normal position the pusher advances, driving the work piece before it entirely out of the device and into the jaws of the work holding vise.

The pinion that operates the pusher is inclosed within the device and cannot be seen in the picture. The operating rack may be seen at *G* extending some distance from its guide, through which it is free to slide. The pusher also has rack teeth cut along one side and these two racks cross at a right angle, one slightly above the other. The pinion is long enough so that it is at all times in engagement with both racks.

Rack Has No Movement

The rack *G* is pinned at its inner end to the main frame of the milling machine and has no movement; it is the feeding device that moves. As the machine table is moved back by its cam, a permanent stop attached to one side of the table contacts with the lug *H* on the feeding device. At this instant the transverse hole in part *D* is in exact alignment with the vise jaws, which are open. As the table continues its rearward movement the feeding device must, perforce, go along with it against the tension of the spring.

The rearward movement of the device causes the inclosed pinion to roll along the stationary rack *G* and, as the pinion is also in mesh with the rack teeth of the pusher, the latter is withdrawn far enough to allow a work piece to drop in front of it into the cradle. The table now reverses and moves forward, the device following by virtue of the spring tension. The enclosed pinion rolls in the opposite direction and advances the pusher, driving the piece of work before it into the jaws of the vise which, during all of the back and forward movement, has remained in line.

During the actual feeding movement the table and feeding device are moving together as a unit, the former actuated by its cam and the latter by the spring. It will thus be seen that the feeding movement is brought about by spring tension only, and if for any reason a piece should jam and refuse to go out, the result would be only to stop the advance of the feeding device and allow the table to run away from it.

The vise jaws are opened and closed by the stationary cam *I*, attached to the machine bed at the opposite side of the table. At the rear of the vise there is an eccentric shaft that actuates the movable jaw, and to the end of this shaft is keyed a lever having at its outer end a roll that passes under the inclined surface of the cam *I*. At about the time when the table in its rearward movement has brought the stop into contact with the lug on the feeding device, the roller of the vise-operating lever passes out from under the cam and the jaws are open,

being opened and held so by springs. The table completes its return and again comes forward to this point, during which movement the feeding has been accomplished. Continued movement of the table then closes the vise jaws and carries the work to the cutters.

It is at about this point also that the table changes from slow to fast movement and *vice-versa;* but this has no bearing upon the operation of the device.

As the table continues forward the roll of the vise operating lever passes under the cam *I* and the jaws close. When closed, the pressure comes upon the high point of the eccentric (the position of which is adjustable) which thus acts as a toggle and relieves the cam and lever of the duty of maintaining the grip.

The milling operation is a double one; the two cutters nearest the main bearing of the machine flatting off a side of the round piece in the first position, while the remaining cutter mills the serrations upon a portion of the flatted surface in the second position.

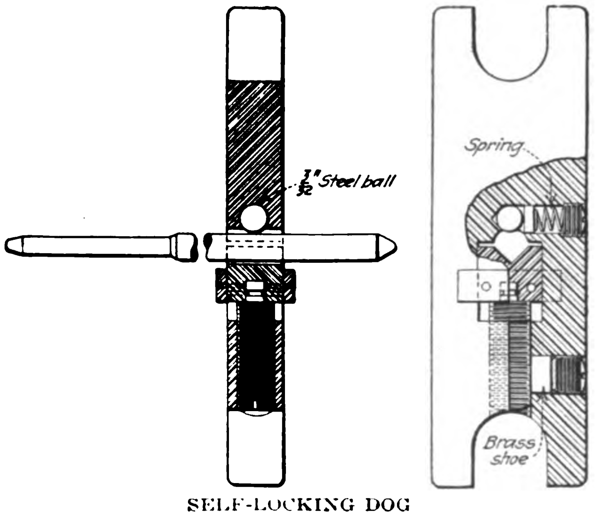
The piece as fed in by the pusher is round; having been previously finished to diameter and length. As the machine goes through its cycle the piece in first position is flatted. At the beginning of the second cycle the incoming piece pushes the already flatted one from first to second position. At the beginning of the third cycle the new piece again pushes the flatted piece forward, and this one in turn ejects the serrated piece from the vise. The machine thus completes one piece at each cycle after the second.

Adjustable Self-Locking Dog for Small Work

By George J. Fallow

Having a large quantity of small pins and piercing punches of different sizes to grind and noting the time lost in dogging them I designed the dog as per sketch and have found it to be a time saver of no small proportion, and well worth the time spent on its construction. The sketch shows the lock to be a $\frac{3}{32}$ in. steel ball with a spring and set screw back of it to hold it in place.

By giving the piece to be ground a slight turn in direction of the spring, it will slide into the dog quite easily, but reverse the motion and it will lock. The more pressure applied the tighter it holds. The V-block is adjusted by the screw in the center and when once set to size is locked by a screw on the side. A brass shoe under the locking screw prevents it from marring the adjusting screw.



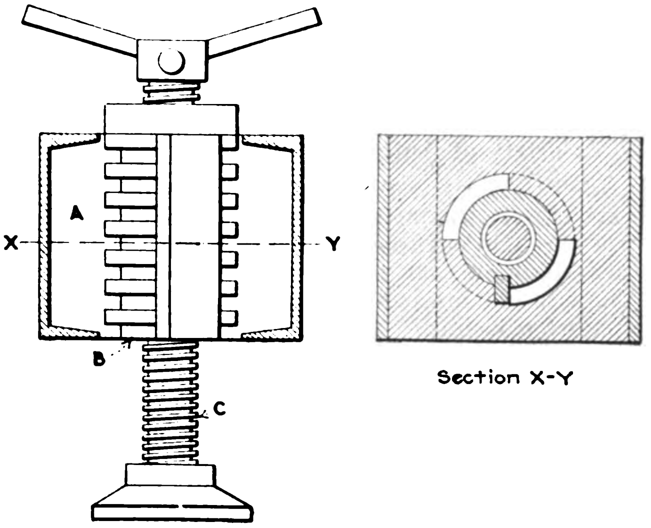
SELF-LOCKING DOG

A Quick Acting Screw Jack

By John S. Watts

At the Wabana Iron Ore Mine, electric shovels are used to load the ore into the mine cars underground. The pile of ore to be loaded is somewhat scattered and requires the moving ahead of the shovel quite frequently. The shovel is mounted on a wheeled truck traveling on rails and there are four jacks, one at each corner, which are screwed down to hold the truck from moving while the shovel is being forced into the pile.

To move the shovel forward involved the screwing up of the jacks some four inches or more to clear the ties,



QUICK ACTING SCREW JACK

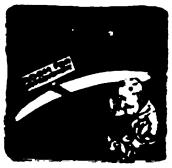
and after moving, the four jacks had to be screwed down a similar distance. To shorten the time required to perform this operation, the jack shown in the accompanying sketch was designed. The nut is made in two parts, *A* and *B*, the part *B* having rings turned on its outer surface which fit into corresponding grooves in the hole in *A*. These rings and grooves are rectangular in form, and equally spaced. The rings on part *B* and the lands in part *A* are machined off for ninety degrees around the circumference on two opposite sides, and a key fitted on one side as shown in the sketch.

In use, after slacking the screw *C* enough to just release the load on it, the part *B* is revolved by means of the handles shown through ninety degrees in a counter-clockwise direction. In this position the rings on part *B* are out of mesh with the lands on part *A*, and *B* can now be lifted up the four inches or so required to lift the jack screw clear of the ties, and then revolved back again ninety degrees into mesh where it will stay until the shovel is moved forward into its new position.

After the shovel has been moved, part *B* is revolved again until the rings are clear of the grooves when it will drop until the screw *C* strikes the ground. Another movement of *B* back to its original position and it is locked again ready for the screw *C* to be tightened up. This arrangement eliminates all movement of the screw *C* except that required to merely take up the weight. The function of the key in part *B* is to prevent excess travel in either direction, and also to stop any tendency for part *B* to revolve with part *C*.

To insure that the rings on part *B* will enter the grooves in part *A*, in any position that *B* may take vertically, the rings and lands are beveled off on the entering edges.

Editorial



NO ONE need hesitate for a moment and try to remember statistics about this and that auditorium or ball room in imperial palaces. The largest room in the world is—the room for improvement. It offers an ever lengthening vista, the further we advance therein. It is immeasurable.

The Production Meeting of the Society of Automotive Engineers

THE FIRST exclusively production meeting of the Society of Automotive Engineers, held recently in Detroit, brought out papers of interest not only to automotive engineers but to production men everywhere. In this issue we are publishing abstracts from eight of the papers presented.

Machine tool builders, particularly, should be interested in the point of view of the automobile factory man on the selection, use and maintenance of machine tools, for some of the highest developments in the application of such equipment have occurred in our automobile shops.

A feature of this gathering, and one which might well be adopted by other branches of the machinery industry, was the free interchange of information on problems common to the whole automobile industry. Automobile manufacturing is a young business, run mostly by young men, and apparently free, to a large extent, from the diseases of knowing all there is to know about your own specialty and guarding that knowledge carefully from the rest of the world. As a result of the progressive spirit manifested in opening up their shops and their minds to new ideas, the automobile men have been successful beyond many other manufacturing fields in putting their business on a scientific and economically sound basis.

As an experiment, this meeting was a huge success and will undoubtedly be followed by others like it. We should like to see every branch of the metal trades attempt something of the sort.

Thanksgiving in 1922—A Real Feast

THERE IS a sound basis for a real Thanksgiving all along the line this year. As a consequence we feel moved to comment on the one holiday on which we always bring out an issue of the *American Machinist*.

Looking backward is an interesting procedure if one does not indulge in it too often. At this time we wish only to go back over five Thanksgiving Days. What a world of change has taken place in that short space of time!

In 1918 we celebrated the national feast only a fortnight after the signing of the armistice which brought the World War to an end. A great feeling of relief from anxiety was everywhere but the wiser ones among us were beginning to think of the hard reconstruction days ahead.

A year later we were not far from the crest of the wild wave of inflation that followed the deprivation and self-denial of four years of war. Money was rolling into the pockets of the laborer and the treasury of the company at an unprecedented rate and but few saw the precipice in front of us.

Before the next Thanksgiving Day the bottom dropped out of the market and times were very bad indeed. A glance at the files of the *American Machinist* shows that our editorial page for the Thanksgiving issue was devoted to a denunciation of contract cancellation and other evidences of business demoralization.

By November, 1921, the worst was over and business men were beginning to congratulate themselves that they were still solvent and looking hopefully to the future. The business tide was still at a very low ebb. however, and unemployment was so serious a menace that a conference was called at Washington to consider ways and means of meeting the situation.

And now we have reached another Thanksgiving Day. Some industries have been booming along for months, others are just reaching the stage of prosperity, while even the machinery industry is getting orders that seem almost like those of the proverbial good old days. We may have to skimp a little on coal this winter but unemployment is a thing of the past and wage increases are being dictated by the excess of demand for labor over the available supply.

A labor shortage is a pleasant thing for the worker to contemplate as it means the laying of the unemployment specter which is almost always lurking before his subconscious mind. But it should be even pleasanter for the machinery manufacturer as it means inevitably a quickened interest in labor saving devices of all kinds and a ready market for his products.

Truly this is a better Thanksgiving than we have had in years, with business on a sound basis and the tide of prosperity on the flow, employment for everybody and new markets constantly opening ahead.

May we make the most of our opportunities!

Just Suppose

JUST suppose two men try to sell you a machine for heavy work, that is to say each one tries to sell his own make. And suppose one of them points out that his driving pulley is of larger diameter and will take a wider belt than the other one. You would probably be inclined toward that machine, provided, of course, that they were equal in other points.

Now suppose you need a new furnace for your home and one maker points out that his machine can assimilate much more coal than any other, would you buy that furnace, or would you say: "What I want is a furnace which burns little coal, and gives much heat, especially this coming winter." Wouldn't you say that or something similar?

Oh, yes, a salesman would not call your attention to the fact that a great deal is required to run the thing—at least not when he tries to sell a furnace. Well, but—

Just suppose.

Shop Equipment News

Niles-Bement-Pond 60-Inch Heavy-Duty Engine Lathe

An engine lathe of 60-in. swing and for heavy duty that has recently been developed by the Niles-Bement-Pond Co., 111 Broadway, New York, N. Y., and built at its Pond Works, Plainfield, N. J., is shown in the accompanying illustration. The machine is fitted with a constant-speed motor of 40 hp., and it has twenty-four faceplate speeds obtained by change gears operated by levers located on the headstock.

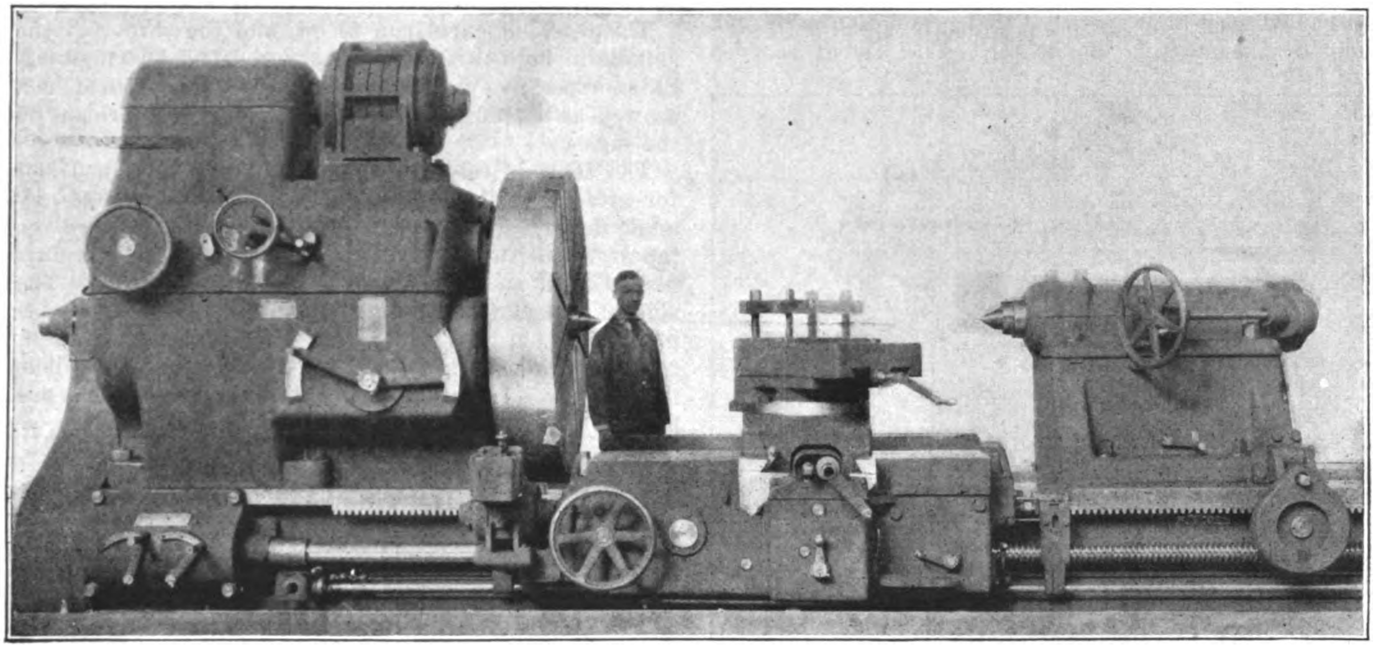
When an adjustable-speed direct-current motor is used for driving, the geared speed changes in the head above the joint line are eliminated without reducing the speed range of the faceplate. The motor is then mounted on the head near the faceplate and the drive taken from it at the outer end of the machine. The motor may be started and stopped by a handle mounted on the carriage. When direct-current drive is employed, any faceplate speed within the range of the motor may be obtained by the use of the same handle. A pushbutton on the headstock may be used for "jogging" the driving motor to give quick and easy shifting of the speed-change gears.

The headstock is heavily constructed and is entirely inclosed, to prevent injury to both the operator and the gearing. All bearings and gears are continuously oiled by means of a pump supplying filtered oil to a reservoir in the upper part of the head, from which it is distributed by pipes. The surplus oil drains into a settling tank in the base of the head, from which it is pumped through a filter back to the reservoir.

The spindle bearings are very large, and on account of the slow speed of rotation, are fitted with oil distributing rings and large oil wells, in addition to the continuous oil supply. The faceplate has four pairs of parallel slots at right angles to permit attachment of faceplate jaws. The tool-steel centers are hardened and ground and fitted with large spanner nuts to aid extraction.

Adjustment of the tail spindle is accomplished through gearing by means of a handwheel located on the side of the tailstock in a position convenient for the operator when placing work between the centers. The upper portion of the tailstock has a cross adjustment operated by a screw for use in turning small tapers. It is clamped to the lower section by heavy bolts independent of those which clamp the tailstock to the bed. The adjustment of the tail spindle is not changed when moving the tailstock on the bed.

In addition to the bolts which clamp the tailstock to the bed, there is a pawl engaging a ratchet so as to brace the tailstock and prevent slipping under very heavy end thrust. The pawl may be lifted out of the ratchet by a handle on the front of the tailstock. The ratchet is made in sections and is easily removable to allow cleaning out chips that may accumulate in the bed.



NILES-BEMENT-POND 60-INCH HEAVY-DUTY ENGINE LAT

The tool carriage has lateral, cross and angular power and hand feeds, and also a rapid traverse along the bed operated by a 5-hp. motor. This motor is connected with a drum switch having a spring return to the off position and mounted on the carriage. The control of the driving motor also is obtained through a handle on the carriage. The tool slide is the full width of the bridge and has clamping bolts and straps for securing the cutting tools. Large micrometer collars are fitted on the crossfeed screws.

The apron is of the one-piece type. All shafts have bearings at each end and the gears and bearings are oiled from one reservoir, which is filled from the top of

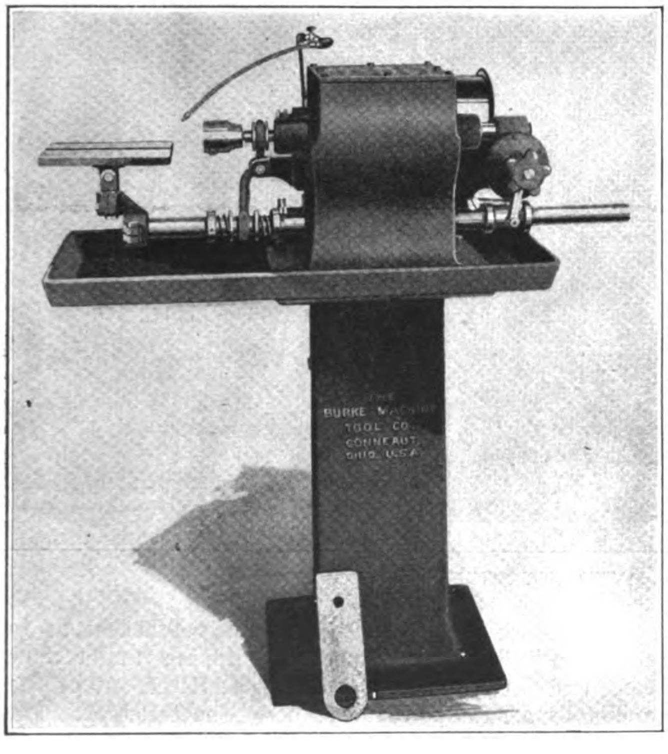
the carriage. The direction of any feed may be changed and started and stopped at the carriage. The levers are conveniently located and are so interlocked that no two feeds can be engaged at the same time.

The thread of the leadscrew is used only for thread cutting, feeds being obtained from a spline in the screw. A quick-change gear box gives four feeds without the necessity of removing gears. Removable change gears can be provided for obtaining any other feeds or threads that are desired. All gears and bearings in the feed box are oiled from a tank providing an ample supply of lubricant.

On lathes with long beds, the lead screw and controller shaft are supported at intervals by bearings which are automatically spaced by the carriage. A steady rest having five jaws with screw adjustment and large wearing surfaces is included in the equipment.

Burke No. 10 Automatic Tapping Machine

The Burke Machine Tool Co., Conneaut, Ohio, has recently put on the market the horizontal-spindle automatic tapping machine that is illustrated herewith. The machine has a capacity from $\frac{1}{8}$ to $\frac{5}{8}$ in. in steel, and can be run at very high speed, so that production is limited only by the stamina of the tap. The use of relieved



BURKE NO. 10 AUTOMATIC TAPPING MACHINE

taps is recommended. It is stated that the production does not depend on the experience of the operator, as the automatic features of the machine give rapid production even with unskilled operators.

The machine is driven by a constant-speed belt, and may be run directly from the lineshaft. If several different sizes of taps are to be used in it, a countershaft giving three speeds can be provided.

The chief feature of the machine is that it is equipped with a power feed and an automatic reverse. It is not necessary to depend on the pressure on the tap to make the machine drive and reverse, such as with hand-operated machines. Since the tap runs perfectly free, the tendency to cut oversize is eliminated, and an accurate thread can be cut.

It is only necessary for the operator to place the work on the machine and push it against the tap until the latter has entered the hole. The power feed then engages and drives the tap until the thread is completed. At this point, the spindle automatically reverses and backs the tap out at twice the forward speed. Since the operator does not need to press the work against the tap during its forward motion and to pull it outward during the reverse motion, his hands are free to select another piece for the next cut. The mechanical feed gives a more uniform and rapid production than hand feed.

The machine drives through a friction mechanism governed by the automatic feed, which is in turn controlled by another friction device. By this arrangement, the machine may be set for very sensitive operation, so that it will slip before breaking taps of small size. It can also be adjusted to pull large coarse-thread taps. The machine is driven through the frictions on both the forward and the reverse motions. These frictions are of taper cone design and the ring keyed on the spindle fits both the driving and the reversing cones.

The working parts run in oil, and the thrust of the spindle in both directions is taken on ball bearings. A Skinner positive-drive tap chuck is regularly furnished, as well as a pump and tank for supplying lubricant to the taps.

The table is fully universal and fitted with a T-slot for attaching jigs, so that holes can be tapped at any angle desired in the work. The table is fed toward the tap by positive power feed. A faceplate also is furnished to fit on the drawbar in place of the table. The side of the plate opposite the front of the machine is planed so that jigs or fixtures may be attached to it, the tap entering the work after passing through a hole in the plate. In this way, parts can be tapped that are larger than can be handled on the universal table.

Baker Ball-Bearing Air Compressors

The Baker-Hansen Manufacturing Co., 1900 Park St., Alameda, Calif., has recently added to its line of ball-bearing air compressors. Larger sizes in both duplex and two-stage machines are now made, and compressors can be furnished with capacities from 5 to 50 cu.ft. of air per minute.

In Fig. 1 is shown a duplex compressor fitted with a glass cover on the crankcase so that the arrangement of the ball bearings can be seen. The machine is constructed similarly to the two-stage type, except that both cylinders are of the same diameter. Both pistons are made integral with a bar that passes from one cylinder to the other. A small connecting link is pivoted at one end on one piston, and run on the ball-bearing crank at the other end. Thus all rotating movement is carried on ball bearings, so that friction is greatly reduced. The bearings are easily accessible for replacement when they have become badly worn.

A ring valve with an automatically operated diaphragm is employed. This valve requires a smaller space than a poppet valve, and thus reduces the amount of piston clearance. An unloader is provided so that the machine can be started without load, and the load gradually put on. A pressure switch of the two-pole type having a one-piece diaphragm is used. This switch

can be sealed so that it operates at any desired pressure to stop the compressor automatically when the pressure has been built up to the predetermined point.

The cylinders are cooled by water circulated from the hoppers by means of the thermo-siphon system. Each cylinder has a strainer to prevent dust from entering.

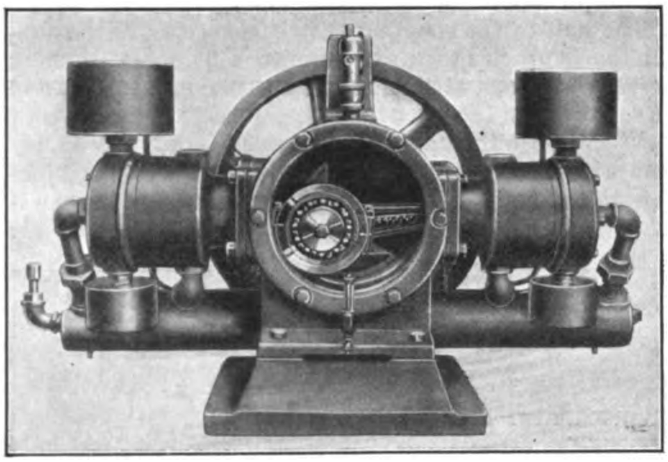


FIG. 1—BAKER DUPLEX BALL-BEARING AIR COMPRESSOR

The receivers are of welded and riveted steel. The compressor and the motor are mounted on cast-iron bases bolted to channel iron and placed on top of the tank, as shown in Fig. 2. Belt drive is employed. The arrangement is such that a minimum floor space is required for the installation.

The latter illustration shows a two-stage compressor having a capacity of 25 cu.ft. of air per minute and working at pressures between 140 and 175 lb. The air is first compressed in the large cylinder, then passed to the copper inter-cooler, and finally compressed in the small high-pressure cylinder. Machines of this type can be furnished for operation by either 1 or 5 hp. motors,

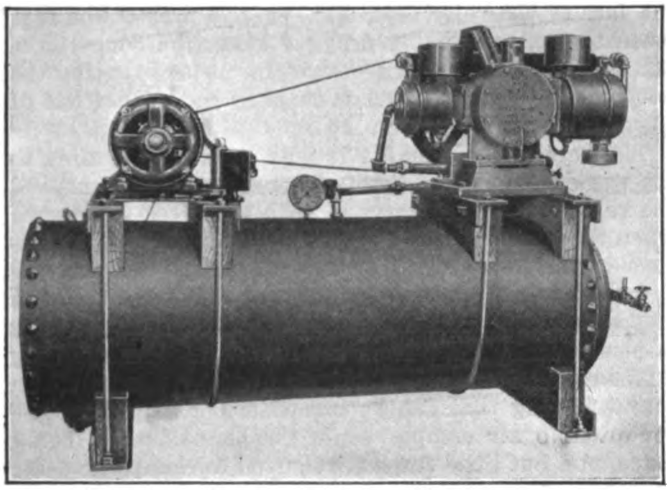


FIG. 2—BAKER TWO-STAGE BALL-BEARING AIR COMPRESSOR

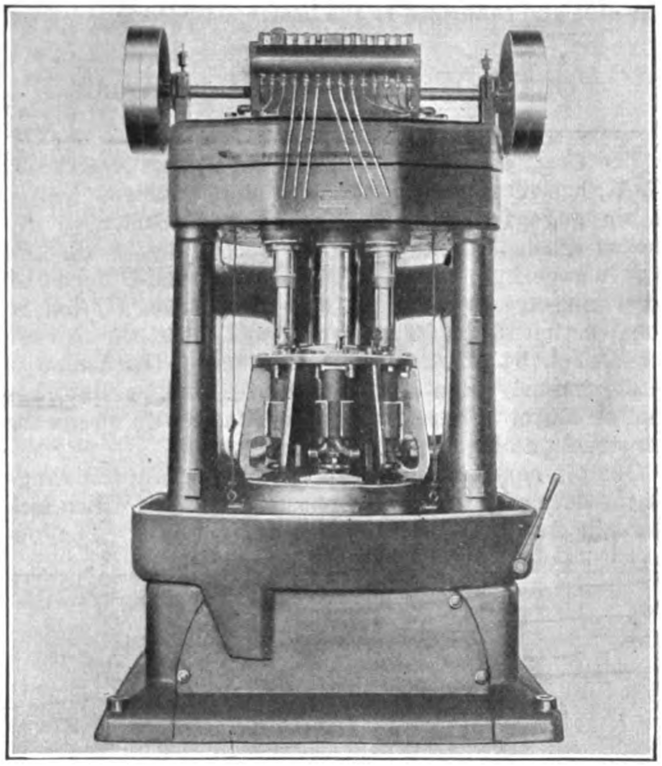
and tanks of different sizes can be provided, according to the nature of the work.

The duplex machine is provided for working pressure of 120 to 150 lb. per square inch for motors of 3, 5, 7½, 10 and 15 hp., depending upon the output required. A variety of sizes of tanks and motors can be coupled to three standard sizes of compressor proper to suit the equipment to varying conditions.

Manufacturers' Consulting Engineers Multiple-Spindle Cylinder Boring Machine

A multiple-spindle machine for boring gas-engine cylinders and finishing the head at one end of the bore has recently been developed by the Manufacturers' Consulting Engineers, McCarthy Building, Syracuse, N. Y. The machine is shown in the accompanying illustration equipped for boring air-cooled automotive-engine cylinders, although it can also be employed for boring cylinders cast *en bloc*.

There are five spindles in the machine; they do not move axially, but have only rotary motion. The work is mounted in a rotating fixture having six positions, five working positions and one for loading. The loading and unloading are done while the cuts are being taken,



MULTIPLE-SPINDLE CYLINDER BORING MACHINE

so that the only lost time is that required for indexing the fixture. Three separate cuts are taken for boring, and two for finishing the head of the cylinder, all being performed simultaneously.

The work holder and work are fed upward to the cutting tools by a cam which makes it possible to obtain a quick return, a quick approach, a uniform boring speed, a reduction in feed for machining the head of the cylinder, and a dwell for the final finishing of the head. It is stated that the time required for the complete cycle of the machine when boring a cylinder 3¼ in. in diameter and 9 3/16 in. long is 1½ min. Where cylinders are machined in blocks having removable heads, the machining time is reduced.

Unusual rigidity is claimed for the machine, which feature gives accuracy of workmanship. This rigidity is obtained through the use of a large diameter pilot that is integral with the head of the machine and passes through the ram on which the rotating fixture is mounted. The parts are heavily constructed throughout.

The machine is semi-automatic, the only duties of the operator being loading and unloading the work while

the machine is in operation, indexing the fixture when the machine comes to rest automatically at the end of its quick return, and engaging the clutch after the fixture has been indexed.

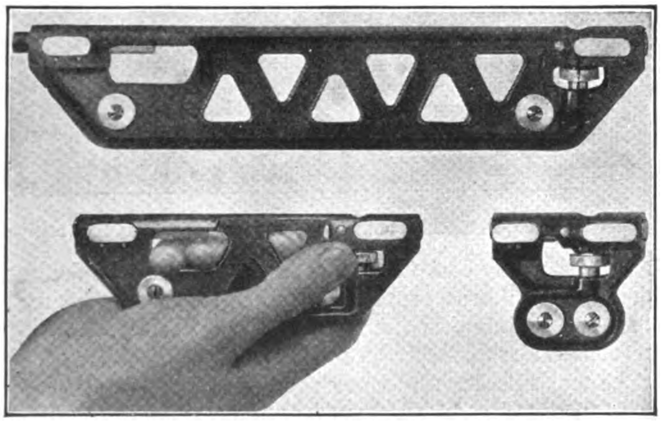
Coolant is employed to keep the cylinder at an approximately constant temperature throughout the cut, so that no distortion due to heating occurs. The coolant is pumped through the spindles and discharged adjacent to the cutting tools on the surface to be machined. It serves to wash away the chips as soon as they are formed. Passing the coolant through the spindles keeps them and the bearings at a constant temperature.

The machine is of considerable size. Its height from the floor to the top of the pulley is 8 ft. 2 in., and the base is about 5 ft. square. The machine is belt driven, with the driving pulley on top of the spindle head. A central oiling reservoir is mounted at the top of the machine and connected to the bearings by tubing.

Pratt & Whitney Adjustable Limit Pin Gage

The Pratt & Whitney Co., 111 Broadway, New York, N. Y., has recently added to its line of precision gages, a pin gage for making internal measurements. By means of its adjustable limits it combines a Go and No-Go gage in one unit. Two spherical-ended hardened steel pins are carried in a cast-iron frame, similar in construction to the "Trusform" gage described on page 1,144, Vol. 54 of *American Machinist*. The frame is built similarly to a bridge truss to combine lightness and strength. The accompanying illustration shows the construction of gages of different lengths.

One pin can be adjusted to any size within the range of the device by means of opposed setscrews which lock the pin firmly in position when tightened. The opposite pin works between two stops, one of which is adjustable to give limits from 0.001 to 0.025 in. The pin can be quickly moved by the thumb and finger of the hand in which the gage is held, the position being shown by the view on the left at the bottom of the illustration. The fingers can be turned in one direction to bring the pin to the Go position, and in the other direction to bring the pin to the adjustable stop for the No-Go size.



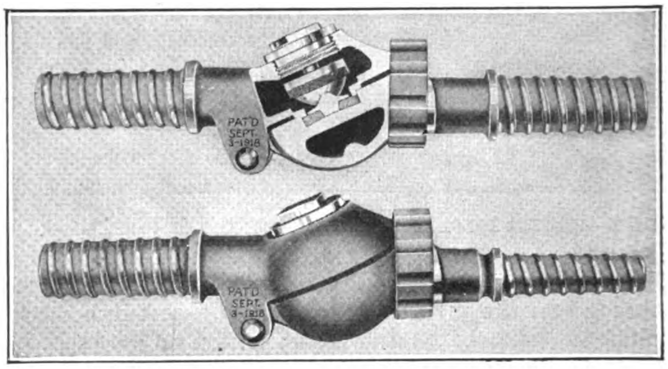
PRATT & WHITNEY ADJUSTABLE LIMIT PIN GAGES

The adjustment may be sealed to prevent tampering with the measurements. The setting can be tested at any time and change made to compensate for wear. Four removable brass disks provide space for marking sizes and other necessary information.

Robinson Automatic Air-Hose Coupling

An air-hose coupling recently placed on the market by the Robinson Machine Co., 39 Eighth St., Muskegon, Mich., is shown in both exterior and sectional views in the accompanying illustration. The purpose of the coupling is to prevent loss of air in the supply line when adding or removing lengths of hose.

The half of the coupling that is connected to the supply line is provided with an automatically operated check valve, which operates as soon as the coupling is parted so as to retain the air pressure. In this way lengths of hose can be either added or removed from the supply line without loss of air, a feature which prevents kinking of the hose. Neither is it necessary for the operator to go continually to the pipe line to turn the air on and off when it is desired to change tools or uncouple the hose. Tools may be changed by simply uncoupling and coupling at the work, so that the time of the operator is saved.



ROBINSON AUTOMATIC AIR-HOSE COUPLING

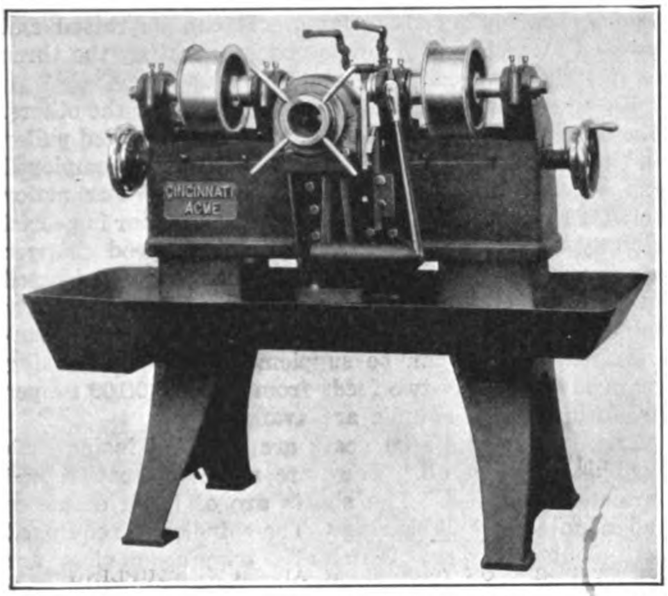
The check valve consists of a brass stem having a leather disk valve facing that can be easily replaced. The valve stem is centered in a reamed hole in the valve cap. Two projections with a crossbar extend beyond the face of the valve seat, and serve to protect the seat when the valve is being dragged along the floor at the end of the hose. This crossbar forms a pivot for the hook on the hose half when making the connection of the two members.

The half of the coupling to which the hose leading to the work is connected has two small projections beyond the valve face, which serve to push the check valve open when the connection is being made, thus admitting pressure to the new section of the line. This half carries a gasket to give a tight connection. When making a connection the hook on the hose half of the coupling is placed under the pin on the line half. The coupling is then pushed together and clamped by means of an eccentric ring that can be turned either way from the center. No air escapes while the connection is being made, and but little force is required to clamp the parts together. Unclamping can be performed just as readily. The air that escapes during this operation is from the hose on the work side, not from the supply line.

The hose shank halves are furnished with "Positive Grip" hose clamps for holding the hose tightly to the coupling. When desired for pipe lines, the line half of the coupling can be equipped with a threaded nipple. The coupling is made interchangeable in ½ and ¾ in. pipe and hose sizes. The body is of malleable iron, and is not subject to corrosion under ordinary conditions. Oil has no effect on the coupling, as the gasket maintains a tight connection even when oil is present.

Cincinnati Acme Duplex Valve Milling Machine

The Acme Machine Tool Co., Cincinnati, Ohio, has recently developed the hand milling machine shown in the accompanying illustration. The machine is equipped with two opposed spindles and is especially adapted for milling straight and tapered squares or flats, such as are



CINCINNATI ACME DUPLEX VALVE MILLING MACHINE

necessary to give the grip for the wrench on the bodies of valves. Either steel or brass can be cut, and the production is limited only by the speed at which the milling cutters can remove the stock, since changing the work can be accomplished very rapidly.

The two spindles are high-carbon steel forgings, and run in bronze bearings. They are independently driven from a plain countershaft, and when necessary, two speeds can be provided. The ends of the spindles have No. 9 B.&S. tapered holes to receive the milling cutters, and they are also provided with slots in the faces to receive the driving tangs of the cutters. The heads are arranged to swivel, so that either straight or tapered surfaces can be machined. They are mounted on slides which have longitudinal adjustment along the bed by means of the handwheels at each end. Micrometer dials aid in setting the slides, so that accurate adjustment can be obtained.

The bed upon which the heads are mounted carries at the front a vertical slide for the work-holding fixture. Adjustable gibs are provided to compensate for wear. The work-holding fixture is opened and closed by the four-pronged handle. It is similar to an automatic spring collet chuck, and the work is inserted from the front. A slight rotating motion of the handle to the right clamps the work, while a partial turn to the left opens the chuck. After the work has been clamped, the entire chuck is free to revolve. The chuck is arranged for indexing to four positions, and it can be clamped in each by a hardened and ground locking bolt.

The work-holding slide is given its vertical movement by means of the long lever connected to it by links. Motion of the lever causes the work to pass between the milling cutters, thus milling two sides of it simultaneously. As the slide moves downward after the cut is finished, the locking bolt is withdrawn from the work-holding fixture automatically, so that the operator may revolve the chuck with his left hand. In his right hand, the operator constantly holds the operating lever, so that the work can be very quickly fed again between the cutters. The vertical slide is counterbalanced to move freely in either direction.

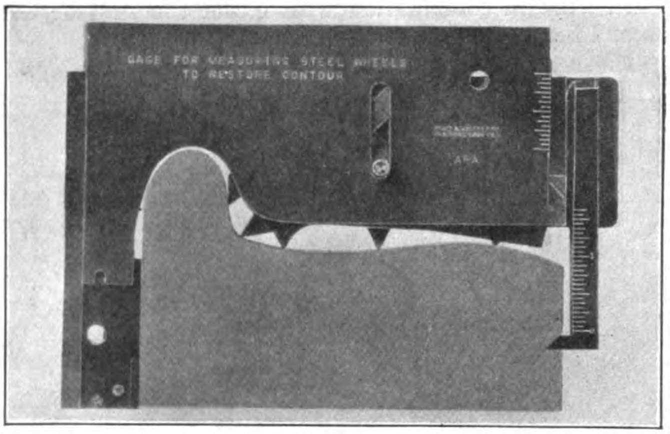
On the back of the bed between the heads there is a small horizontal slide on which is mounted an adjustable stop. The work is brought against this stop, so that all pieces are held alike and the square is machined to the same length on each. A pump to supply coolant to the cutters is also located on the rear of the machine. A large drip pan having a sump collects the coolant after it has passed over the work.

Pratt & Whitney A.R.A. Wheel-Tread Gage

A gage for measuring steel railway wheels when about to restore the proper contour to the tread has recently been placed on the market by the Pratt & Whitney Co., 111 Broadway, New York, N. Y. The gage, which is shown in the illustration herewith, is designated as the A.R.A., since it conforms to the standards and practice recommended by the American Railway Association. It serves to give a direct reading of the amount of service metal still available on used steel or steel-tired wheels, so that this amount may be taken as a basis for billing foreign roads for wheel replacements according to the interchange rules.

The gage indicates the amount of metal that will remain after turning, so that it can be determined in advance whether a worn wheel is worth re-turning to obtain the standard contour. The measurement can be obtained both before and after turning.

In the illustration, the gage is shown applied to a worn tread. The face on the left is held in contact with the wheel, the central pointer is put in contact with the



P. & W. A.R.A. WHEEL-TREAD GAGE

tread, and the hook on the bar at the right is placed in the groove provided in the wheel to indicate the limit of wear. The four sliding pointers are next brought in contact with the wheel and flange. The gage can then be removed for reading.

The sliding front plate is moved downward until its lower edge coincides with the lowest point of the four sliding pointers. The scale on the right of the body of the instrument indicates the amount of metal that must be removed in order to restore the standard contour. The scale on the small bar projecting at the right shows the amount of service metal that will remain after the contour has been restored. The contour may be observed at several points on the circumference of a wheel, so that the maximum wear may be ascertained.

Colburn Special Gang Drilling Machine

A special gang drilling machine having longitudinal movement for one of the heads has recently been placed on the market by the Consolidated Machine Tool Corporation of America, 17 East 42nd St., New York, N. Y., the machine being built at the Colburn Machine Tool Plant, Cleveland, Ohio. The general arrangement of the parts of the machine, as regards the four-spindle column and table, is similar to that in the Colburn gang drilling machine described on page 1,051, Vol. 46 of *American Machinist*. The difference is in fact that there are only two heads permanently mounted on the left side of the column with a fixed center distance between them. The third head is mounted on the right side of the machine on a plate attached to the column and having finished ways.

The movable head has an adjustment of 27 in., and is moved by means of a screw and capstan handle. Provision is made for clamping the head securely in the desired position. The minimum center distance between the adjustable spindle and the nearest fixed spindle is 27 in., and the maximum distance 54 in. The total range that can be obtained by the machine between spindle centers is 27 to 81 inches.

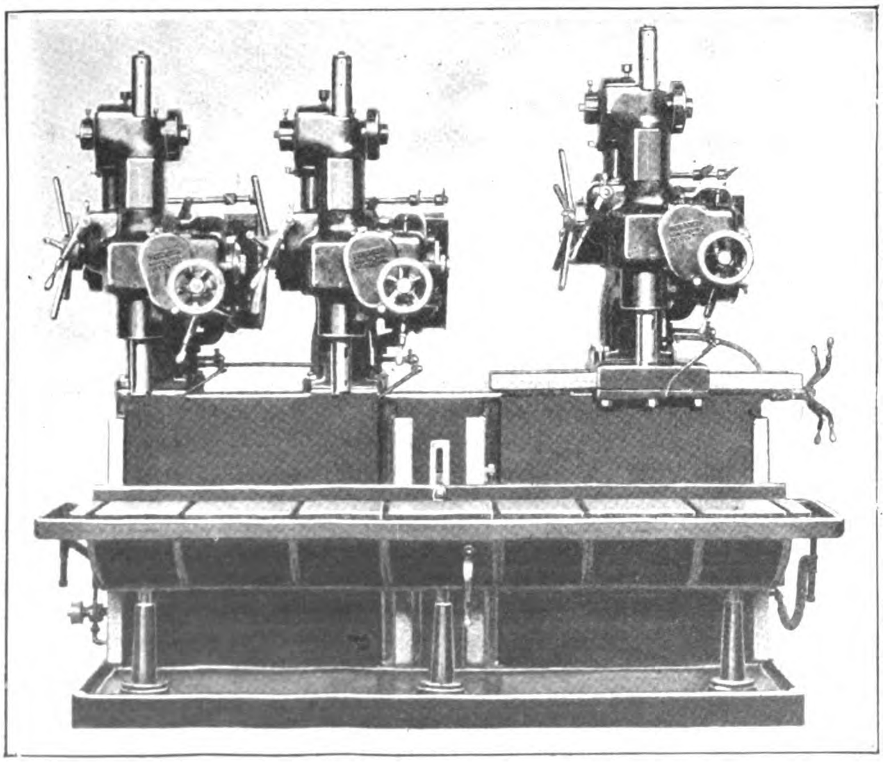
A machine having the same column and table, but with only two heads, can be arranged in the same manner. One head is fixed at the left end of the column, and the other head is movable from the right end over to the first head.

It is easily possible to convert the machine into the regular four-spindle machine with 27 in. fixed center distances between the spindles. The movable head is moved to the left end of its travel, and a fourth head secured to the plate on the right-hand end of the column. By removing the right-hand head, adjustment of the center distance can again be obtained by means of the third head in combination with either the first or the second head on the left.

The heads illustrated are those of the regular No. 4 drilling machine, having a capacity in steel of 2 in., although either the smaller size No. 2 or the larger size No. 6 machine, such as described on page 899, Vol. 55 of *American Machinist*, can be arranged with this mounting. The distance between the center of the spindle and the base of the column is 12½ in., and the machine is rated at 24-in. swing. Supporting screws are provided under the center and ends of the table, and both the table and column are heavily ribbed. The table has a 3-point bearing on the column. It can be raised and lowered by means of a single crank operating the three screws simultaneously.

Each head can be operated independently of the others. The drive is ordinarily by belt to a constant-speed pulley on each head, although a countershaft may be employed and attached to the rear of the machine. For motor drive, a ball-bearing countershaft near the floor is geared directly to the motor. Two mechanical speed changes are provided, although removable change gears located on the left side of each head may be used to furnish fifty spindle speeds from 40 to 500 r.p.m. The two mechanical feed changes can be supplemented by transposing gears so that thirty-two feeds from 0.006 to 0.109 in. per revolution of the spindle are available.

The driving and feed gears are mounted inside each head and run in oil. They are made of heat-treated chrome-nickel steel. The shafts are of large diameter and mounted on ball bearings. The spindles are equipped with double splines. Automatic tripping devices are provided to control the depth of hole. A pump for coolant can be furnished, with piping to bring the coolant directly to the point of the drill.



COLBURN SPECIAL GANG DRILLING MACHINE

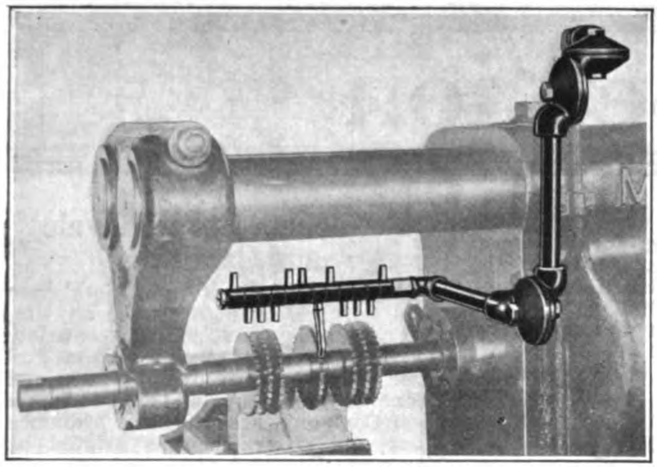
Borgeson "Multi-Production" Lubricator

The "Multi-Production" lubricator shown in the accompanying illustration is a recent product of the Borgeson Tool & Machine Co., Inc., 501 East Water St., Syracuse, N. Y. The lubricator is an attachment for lathes, milling machines and other machine tools, and it serves for directing and distributing the cooling compound to the tools and work. It is equipped with a number of nozzles, so that a flood of coolant can be brought to the position where it is needed to cool the tools and enable continuous production.

The nozzles are mounted on a slotted distributing tube, and are held in position by the tension of a spring. By turning a nozzle on the tube, the nozzle can be brought into position opposite the slot, or it can be turned away from the slot when it need not be used. Since the slots registering with the nozzles are elongated, a considerable range of adjustment is possible for each nozzle in its open position.

The attachment plug by which the coolant is brought to the distributing tube is threaded, and can be located at either the end or the middle of the distributing tube. Standard pipe sizes are employed for the threads, except that a special thread to fit Jones & Lamson machines can be provided.

The distributing tubes can be attached directly to the coolant piping



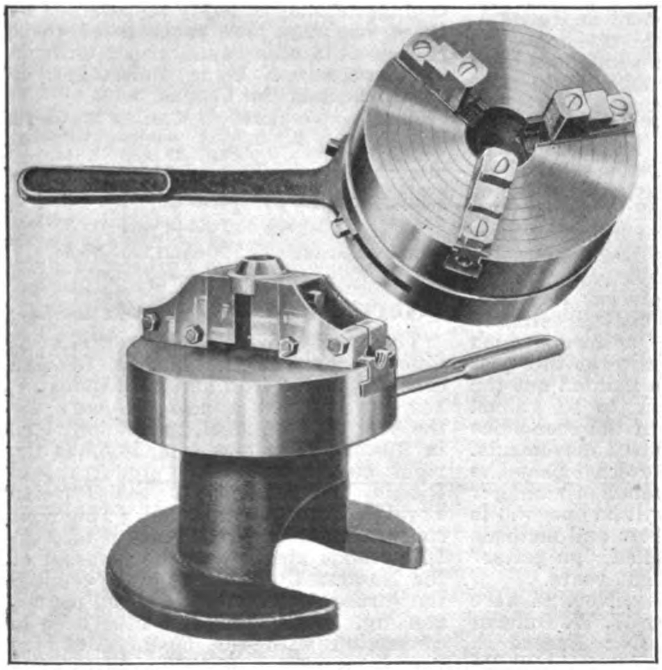
BORGESON "MULTI-PRODUCTION" LUBRICATOR ON MILLING MACHINE

that is furnished on the machine. Where swivel joints are required, an arrangement such as shown on the milling machine in the illustration can be employed. These swivel joints are made either single or double and allow the distributor to be swung into any position. The joints have large ground friction surfaces and do not leak or allow the nozzles to jar from position when the machine is in use.

From six to twenty nozzles can be furnished on the distributing tube, with a ½-in. pipe thread connection. Spouts 2½, 3½ and 4½ in. long for attachment to the nozzles can be furnished from stock, and special lengths and shapes can be supplied on order.

Changes in Barker Wrenchless Chuck

The Thomas Elevator Co., 22 S. Hoyne Ave., Chicago, Ill., manufacturer of the Barker wrenchless chuck and drilling machine vise, has recently made several changes in the design of the chuck, which was originally described on page 881, Vol. 42 of *American Machinist*. The cam mechanism has been redesigned so as to obtain greater strength and a greater travel of the jaws, which makes it possible to handle a wider range of irregular work than heretofore.



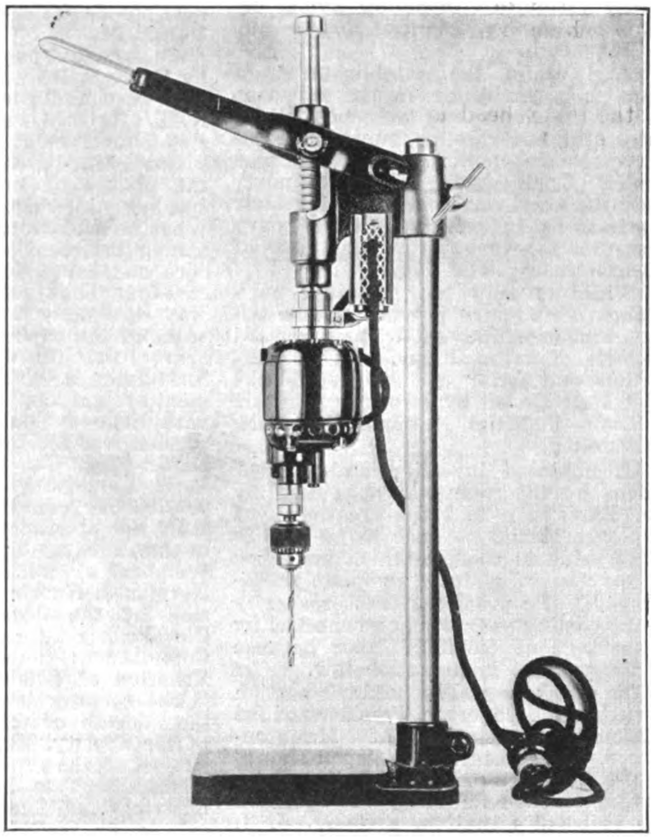
BARKER WRENCHLESS CHUCK AND DRILLING MACHINE VISE MADE BY THOMAS ELEVATOR CO.

In the smaller sizes of the chuck, a box cam eliminates the necessity for the use of trunnion arms, and in the larger sizes, the arms have been redesigned to obtain greater strength and a wider range of movement. These changes make it possible to apply a large leverage without injuring the chuck. At the top of the accompanying illustration is shown a three-jaw lathe chuck, while a two-jaw drilling machine vise is shown at the bottom.

Jones Automatic Sensitive Bench Drilling Machine

A small electric-driven sensitive drilling machine for use on a bench is shown in the accompanying illustration. The machine has a capacity for drilling holes up to ¼ in. in diameter in steel, and it has recently been placed on the market by Joseph W. Jones, 29 West 35th St., New York, N. Y.

The principal feature of the machine is that it is equipped with a device for automatically starting and stopping the motor as the handle is lowered and raised.



JONES AUTOMATIC SENSITIVE DRILLING MACHINE

The motor and the drill do not revolve when the handle is in the raised position and no work is being done. Electric current is saved in this way, and wear is reduced on the parts, since they do not run during the time in which the operator is changing the work underneath the spindle.

The motor drives the spindle through gears, and is operated on current taken from a convenient lighting circuit. The whole installation is very easily portable. The machine is particularly suitable for manufacturing purposes, where light drilling operations are required. The base is 7½ x 6 in. in size, and the column 20 in. high. The net weight is only 18 pounds.

News Section

National Founders Hold 26th Annual Convention

The responsibilities of employers to their employes, with particular emphasis upon the thought that an honest return from labor is predicated squarely upon the giving to labor of honest treatment, was the subject of the annual report of William H. Barr, president of the National Founders' Association, delivered last week at the twenty-sixth annual convention of the association at the Astor Hotel, New York City. Mr. Barr said, in part:

"We have passed through a year of industrial readjustment and conflict, the upward progress of which is complicated; not only by social chaos throughout the world, but also by two national utility calamities involving public deprivation, heavy financial losses and violent death.

"And while the establishment of open shop conditions on the railroads and in the coal mines were not wholly successful, nevertheless, substantial improvement in operating conditions was made. Great credit is due to many executives and mine operators for their fearlessness in refusing, under heavy pressure, to waver from the path of conscientious public duty.

"While it may be true that each branch of industry is more or less selfish, I believe that its attitude toward subjects of national concern no organization—industrial or otherwise—has ever been guided by stronger patriotic motives than the National Founders' Association.

An unbiased investigation of labor unions by Congress was suggested by Mr. Barr. He said the treatment of employes should be such as to inspire "that pride in the job which the labor unions have almost completely destroyed." He predicted that prosperity in the coming year would be checked by a shortage of unskilled labor because of the present immigration law.

The speakers at Wednesday's session were John E. Edgerton, President of the National Association of Manufacturers, who talked on the "open shop;" L. F. Loree, President of the Delaware & Hudson Railroad, who spoke on the railroad situation, and Dr. J. J. Moorehead, whose subject was "The Physician in Industry."

The feature of Thursday's session, Nov. 23, was the talk on "Improved Foundry Practice," by D. R. Wilson, vice-president of the Wilson Foundry and Machine Co., Pontiac, Mich. Mr. Wilson's paper was supplemented by a detailed lantern slide talk by H. M. Lane, foundry expert of the Wilson Co., describing in an instructive manner the operations, processes and methods employed in the Pontiac foundry in securing large scale production.

Colonel Samuel Harden Church, President of the Carnegie Institute, Pittsburgh, was the speaker at the annual dinner. At the final session William H. Barr was re-elected president of the association for the ensuing year and Chas. L. Taylor, of the Taylor & Fenn Co., Hartford, Conn., was elected vice-president.

The attendance upon the convention was one of the chief features, more than fifty per cent of the entire membership being present.

Annual Meeting of Taylor Society

The growing interest in scientific sales and production management was evident last week in the large attendance of keenly interested executives from many lines of industry upon the sessions of the annual meeting of the Taylor Society which held a three-day convention at the United Engineering Societies Building, Nov. 22, 23 and 24.

An excellent paper was that delivered by Percy S. Brown, Works Manager of the Corona Typewriter Co., Groton, N. Y. Its title was "The Organization and Management of a Medium-Sized Plant." The presentation covered all the phases of management, and the speaker was not sparing in detail. What he said aroused great enthusiasm among the members of the large audience and called forth considerable discussion. That the criticism was in no way destructive was evidence of the value of the paper and the belief of his hearers that Mr. Brown's company has formulated a highly efficient management system and is conducting its plant with little avoidable waste. The discussion was led by L. H. Ballou of the Lewis Mfg. Co., Walpole, Mass., and R. H. Landsburg, Horton School, University of Pennsylvania.

In the afternoon Harry B. Horwitz of the planning department of Harry A. Wembridge, statistical division and Herman J. Hutkin of the methods division of the Joseph and Feiss Co., Cleveland, read a paper on Statistical Compilation: Some of its Uses as a Function of Scientific Management.

The evening session was marked by the address of the managing director of the Society, Mr. H. S. Person. The subject of the paper was "Shaping Your Management to Meet Developing Industrial Conditions." The paper was an exhaustive study of present day economic changes with a critical estimate of the management methods which have obtained in industry in the past few years. Mr. Person pointed out the great value to industry to be gained by research and study of the economics of raw material and price movements. He concluded with a forecast that the successful sales or production manager of the next ten years will be one who is a keen annalist of markets and methods rather than the so-called "go-getter" type in evidence in recent years.

The sessions of Friday, Nov. 24 were given over to papers by W. W. Duncan of the Hood Rubber Co.; Ernest E. Brooks of the Dennison Co.; and Philip J. Reilly, associate director of the Retail Research Association.

Bethlehem Buys Midvale and Cambria

The board of directors of Bethlehem Steel Corporation at a special meeting held yesterday authorized contracts for the purchase of the plants and other assets of Midvale Steel and Ordnance Company and of Cambria Steel Company, accepting the ordnance plant and other business located at Nicetown, Pa., and assets appurtenant thereto.

In payment for the properties to be acquired, Bethlehem Steel Corporation, besides providing for the assumption of the bonds and other indebtedness of the Midvale and Cambria companies (excepting current liabilities appurtenant to the operation of the Nicetown plant), will issue about $97,650,000, par value, of the Bethlehem common stock, of which $95,000,000, par value, will go to the Midvale company for distribution on dissolution to its stockholders, and the balance to the holders of the stock of Cambria not held by Midvale.

Further Decline in Structural Sales

A marked seasonal decline in the sales of fabricated structural steel in October is announced by the Department of Commerce from reports made to the Bureau of the Census. October sales amounted to 54.9 per cent of shop capacity, compared with 61.6 per cent in September.

Reports received from 140 identical firms from April through October, with a shop capacity of 221,790 tons per month, show the following actual tonnages booked each month and the percentage of shop capacity represented by these bookings. A revision of these capacities in accordance with a uniform standard is now being undertaken by the Bureau of the Census.

	Tonnage Booked	Per Cent of Capacity
April	191,805	86.5
May	172,260	77.7
June	153,278	69.1
July	141,907	64.0
August	143,515	64.7
September	136,587	61.6
October	121,763	54.9

German Activity in Russia

The well-known Wolf concern of Cologne, one of the largest German concerns in the iron and steel industry, has just formed a new company for the sale of iron, steel, machinery, etc., in Russia. The new company has the right to import these products into Russia, independent of the Russian Foreign Trade Commission. The Wolf concern has placed the amount of 750,000 pounds sterling to the disposal of the Russian Government and promised the further payment of 500,000 pounds sterling. Both sums are to be used in connection with the business of the new company. Branch offices and depots will be opened in a number of the larger Russian cities.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

HERE are the more important items in the Farm Bloc program as announced by its titular leader, Senator Capper, as Congress convened:

"A complete rural credit organization.

"A reduction in freight rates.

"A re-establishment of state control over intra-state railway traffic.

"A better marketing system.

"The delivery of the Muscle Shoals project to Henry Ford.

"An income tax on corporate surpluses and stock dividends.

"A constitutional amendment prohibiting tax exempt securities."

Other congressmen within and without the Farm Bloc are demanding that a Bonus Bill which will cost no one knows how much shall be passed, and if necessary repassed over a possible veto, and in his speech urging a ship subsidy that will call for from 20 to 50 million dollars a year the President said that the Administration would lend a "willing ear" to any measures that will mitigate the distress of the farmer who is "the chief sufferer from the cruel readjustments which follow war's inflation."

In thus summarizing what is asked of Congress it is not intended to criticize or oppose any of the proposals made. They are all debatable. Each one has the backing of an important portion of the body politic and the demand for lower freight rates will certainly be very popular with every one but the railroads.

But it is also to be observed that in its entirety the program is avowedly agrarian and contemplates a heavy increase in the taxes that are directly paid by invested wealth. Therefore it is not surprising that stocks and bonds have declined. The railroad shares have been especially weak, upon the theory that there might be an early reduction in freight rates, but the stocks of the forty odd big corporations that have recently declared stock dividends have also dropped as the recipients of these dividends have been turning them into cash and buying tax exempt bonds in an effort to prepare for the deluge of new taxes that is anticipated.

But the depreciation that has taken place since Sept. 25, when I first called attention to the change of sentiment, is not primarily due to the selling of any particular group or individuals. Capital, which was growing cautious as the election approached, has been seriously alarmed by the size of the radical vote cast, and the epidemic of fear now prevalent will probably run its course. It is futile to point out that the old Congress now in session will expire by limitation on the 4th of March. That it is unlikely that it will pass any legislation of importance except the appropriation bills. That the newly elected Congress cannot meet before December, 1923, unless the President calls a special session, which is unlikely, and that we probably have a year of comparative political tranquility ahead of us.

All this is forgotten or ignored. But when the wave of pessimism and fear that is now sweeping the investment market has subsided it will probably be found that prices have been carried too low and that the time to buy is when, as at present, most people are eager to sell. This is why I am now disposed to suggest that those who have common sense and money should commence looking for bargains in the confident belief that the people of this country will, in the future, as in the past, find a way to avoid being ruined by fool legislation.

The commodity markets and business generally have not as yet felt the stock market depression, nor is it logical that they should, for most of the proposals by which investors have been scared are intended to benefit the farmer and the wage earner.

The scarcity of labor is becoming acute. In the country as well as in the cities there is a job at good pay for every one who wants to work. One result of this is sustained activity in the retail and jobbing trades, but there has been no speculation and the buying is still from hand to mouth.

The railroad congestion is somewhat relieved. The Federal Reserve statement shows a substantial contraction of credit, a gain of $15,000,000 in gold and a higher reserve ratio, but the money market is no lower.

The production of coal is now on a scale which assures an adequate though not a superabundant supply for the winter. Both iron and steel are somewhat lower as the demand for the latter is a little less eager. An excellent demand for copper is reported, but the market is held down to 14 cents by the selling of the large producers who seem to fear that a higher price would lead to the reopening of the smaller mines and a burdensome increase in the supply.

The "edge" appears to be temporarily off the cotton market as in the light of the ginning figures the crop looks a little larger than previously. But the demand for cotton goods is excellent and most of the mills are sold well ahead. Sugar is firmer on the strong statistical position. Wool and woolen goods are steady without appreciable change in price. Rubber is slightly higher. Silk is a shade easier. Hides and leather are steady, reflecting an excellent shoe business, although the upholstery demand is poor.

Our foreign trade figures for October show exports valued at $372,000,000 as against $343,000,000 last year. This is both surprising and encouraging. Imports are not yet reported, the delay being due to the rush caused by the tariff bill.

The news from Europe is still rather sombre. Germany continues to print paper marks at the rate of several billion daily in an effort to avert the inevitable deflation. Financial England seems somewhat heartened by the victory of the Conservatives, but industrial Lanchasire is rather less cheerful and some short time is reported. Sterling exchange has advanced sharply and francs followed but only to lose most of their advance. French business seems to be fairly prosperous despite the financial predicament of the government.

From Russia an amazing recovery is reported since the Soviet government permitted a partial resumption of capitalistic practices, but the news is almost too good to be entirely true and it is probably colored by the self interest of those in power.

Mexico seems to be still in a state of financial instability and irritability, but the outlook elsewhere in Latin America and especially in Cuba is satisfactory and encouraging. In Canada good crops and a dollar that is worth more than 100 American cents are creating a consciousness of prosperity.

Speaking generally it may be said that in the Western hemisphere Thanksgiving Day may be celebrated with real thankfulness for blessings already enjoyed, but in Europe it will be chiefly observed with the gratitude that has been defined as "a lively appreciation of favors yet to be received."

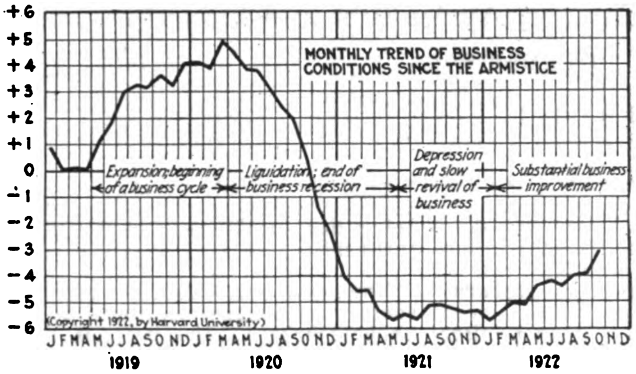
U. S. Leads in Railway Mileage

In the following table, prepared by the Bureau of Railway Economics, the railway mileage of the United States is compared with that of some of the other countries by indicating, through multiples, how many times the mileage of the United States exceeds that of the other countries.

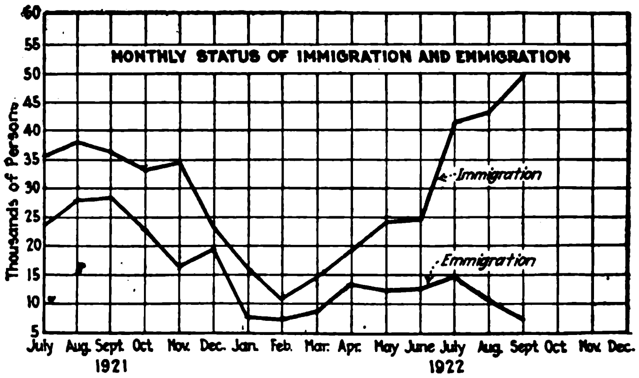
	Railway Mileage	Ratio of U. S. Mileage to Mileage of Country Named
United States	264,373	....
Russia (incl. Asiatic)	51,646	5.1 times
Canada	38,888	6.8 times
British East Indies	36,325	7.3 times
Germany	36,131	7.3 times
France	35,145	7.5 times
United Kingdom	24,396	10.8 times
Argentina	23,156	11.4 times
Brazil	17,478	15.1 times
Mexico	15,841	16.7 times
Italy	12,501	21.7 times

"In other words," says the Bureau, in commenting on the comparison, "the railway mileage of the United States is five times as great as the mileage of Russia, which contains the next largest system of railways.

Monthly status of immigration and emigration in the United States based on returns collected and compiled by National Industrial Conference Board.



Trend of business conditions in the United States based on Bradstreet's price index and Bank Clearings outside of New York as computed by Harvard Economic Bureau.



BUSINESS conditions since the armistice as reflected in the statistics of the Harvard Economic Bureau show that the slow revival of business which set in about January of the current year is continuing steadily upward, with a substantial business improvement reflected in October. Bank clearings outside of New York and Bradstreets price index upon which the curve of business conditions is based show an improvement in October as compared with September of seven-tenths of one per cent.

Bond prices as reflected from the average of 40 representative issues in the New York market fell off slightly in October to $80.82 as compared with $82.14 in October. The decline was largely in sympathy with the share markets, but of no great significance. High grade bonds continue to be attractive and in demand and the average price of the 40 issues shows a progressive advance from $69.71 in January 1921 to the October average without any reaction in that time.

Production of manufactured goods in the United States continues to show the heavy volume which began in May of the current year. The total volume of manufacture reached 99.1 per cent in June, declining slightly in July to 95.3 per cent. Estimates for August and September point to a record volume of production of 104.6 per cent and 101.3 per cent respectively. The chief commodities showing increases of considerable proportions over the early months of the current year are lumber, petroleum, textiles and food.

Comparative Prices of Shop Supplies

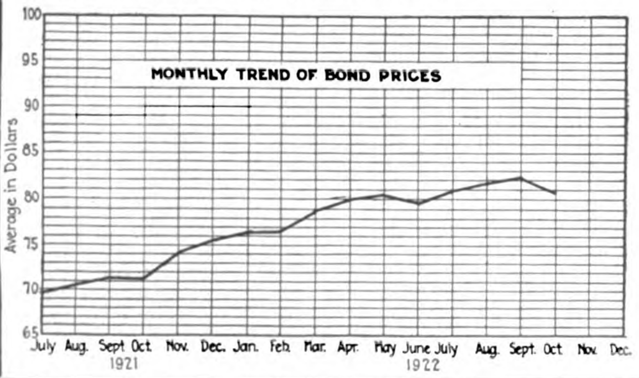
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0295	$0.0295	$0.0273
Cold finished shafting......	per lb.........	0.0378	0.0378	0.0373
Brass rods.....	per lb.........	0.171	0.1700	0.15
Solder (½ and ½)	per lb.........	0.24	0.23	0.20
Cotton waste..	per lb.........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal.......	0.59	0.575	....
Machine oil....	per gal.......	0.36	0.36	....
Belting, leather, medium......	off list........	30–10% @50%	40–5% @50%	—
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

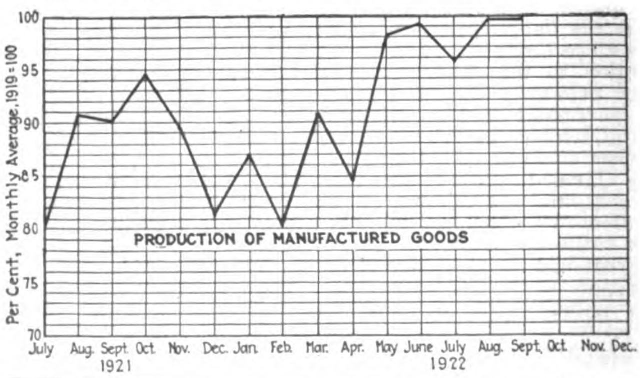
Serious labor shortage, both skilled and unskilled, continues to occupy the attention of the majority of essential industries. Manufacturers associations in convention assembled during the past few months have been unanimous in declaring themselves against the present immigration legislation and in many cases they have passed resolutions favoring amendments to the acts so as to permit the necessary labor to enter this country. Statistics compiled by the National Industrial Conference Board show that since January, 1921, up to date the net gain in immigration over emigration has averaged less than 13,000 persons per month. The result has been a great shortage of workers and a consequent bidding up of labor rates to draw men from one industry into another. One of the matters which will, without doubt, be brought before the next Congress, will be some measure of legislation calculated to relieve the serious situation which has developed, from which all industries suffer.

Loadings of revenue freight continue to be the heaviest in the history of American roads. For the week ending Nov. 11, a total of 953,909 cars were loaded, an increase of 198,132 cars as compared with the corresponding week of last year and an increase of 26,323 cars compared with the corresponding week in 1920. Car shortage continues serious, the total shortage on November 8 totaling 174,498 cars, a decrease of about 4,000 cars from week previous.

Monthly movement of bond averages based on weekly prices of 40 representative railroad and industrial issues compiled and furnished by Times Annalis.



Percentage of total manufacture of steel, lumber, paper, petroleum, textiles, leather, food and tobacco compiled by Federal Reserve Board.



Decrease in Bad Order Locomotives

The railroads of the country repaired and turned out of their shops during the period from Oct. 15 to Nov. 1 last the largest number of locomotives for any semi-monthly period in approximately the last two years, according to reports received today from the carriers by the Car Service Division of the American Railway Association.

During that semi-monthly period, 18,490 locomotives were repaired. This also exceeded by 2,086 the number turned out of the shops from Oct. 1 to Oct. 15 last.

Locomotives in need of repair on Nov. 1 totaled 18,366, or 28.5 per cent of the number on line. This was a decrease of 865 since Oct. 15, at which time 19,231, or 29.8 per cent were in need of repairs.

Of the total number on Nov. 1 last, 15,101 were in need of repairs requiring more than 24 hours. This was a decrease since Oct. 15 of 834 locomotives in the number needing heavy repairs. The remaining 3,265 represented locomotives in need of light repairs, which was a decrease of 31 within the same period.

Reports filed by the carriers show that on Nov. 1 the railroads had 46,096 serviceable locomotives.

Weirton Steel Co. Will Erect Big Sheet Mills

Eight sheet mills involving an outlay of $1,500,000 will be erected in Weirton, W. Va., within a year by the Weirton Steel Co., according to an announcement last week by D. M. Weir, vice-president of the company. Five hundred men will be afforded employment by the completion of the new unit. The output of the mills, Mr. Weir said, would be restricted to black and galvanized sheets and the new department would be conducted entirely separate from the tin unit of the plant.

The construction of the battery of sheet mills will bring the number of hands employed by the Weirton Co. close to the 16,000 mark.

Southern Metal Industry Expanding Trade with South America

Southern metal trades industries have been experiencing an unusual increase in export sales to Latin-American countries the past five or six weeks, according to William E. Dunn, Jr., secretary of the Southern Metal Trades Association, who advises that metal trades products made in the South are in greater demand now in all Latin-American countries than in the past two years. Central, South American and Cuban trade is especially good, with Brazil and Argentine trade in the lead. Porto Rican conditions are rapidly improving, and border trade with Mexico has increased rapidly during the past two months. The outlook, Mr. Dunn states, is for the largest export business with Latin-American in 1923 that the southern metal trades industries have yet experienced.

New Process Gear Plans Expansion

Definite plans for the expansion of the New Process Gear Corporation of Syracuse, recently purchased for $2,100,000 by T. W. Warner, of Toledo, vice-president of the Durant Motors, Inc., are being worked out. The plant has been working at full capacity producing gears for both the Durant and Star cars for several months, and it is understood that the plans being formulated call for a larger plant. C. R. Burt is managing the plant for Mr. Warner, and it is understood that he will remain at the head of it.

The Alliance Machine Co., Alliance, Ohio, according to reports, has booked orders for thirty-one cranes and hoists during the past month.

Supreme Court Denies Duesenberg Claim

The possibility of an armistice ending the world war was a factor influencing contracts for war supplies in which the contractor should share responsibility in certain classes of cases, according to a decision of the United States Supreme Court, rendered Nov. 13 in denying a claim of the Duesenberg Motors Corporation against the government for $152,808.93. The Court of Claims had dismissed the claim and the Supreme Court upholds this action.

The Duesenberg corporation entered into a contract to manufacture airplane motors, the contract being changed twice, first to enlarge an order for Liberty motors and later to change the type to Bugotti motors. Specifications were delayed and at the same time the plant was not fully ready, when the armistice ended the need for the motors. The corporation claimed the $152,808.93 to be due it in addition to the amounts which were paid it by the government.

Leather Belt Men Hold Educational Sessions

A three-day educational session of the Leather Belting Exchange was held at the Hotel Pennsylvania, New York, N. Y., November 16, 17, 18. As the purpose of the meeting was to interest the members in the finer points of leather belting manufacture, the main feature was a description of the experimental work carried on by the scientific research committee in its laboratory at Cornell University.

R. F. Jones, the research director, discussed "Research Work in Leather Belting," following his address with a demonstration of a miniature of the apparatus in use at the Cornell laboratory. Among the other subjects taken up were: How a Belt Transmits Power, by J. E. Rhoads, chairman research committee; The Belt vs. the Motor—the Costs of Belt Tensions, by R. C. Moore, chief engineer, Chas. A. Schieren Co.; The Chain Drive in Its Relation to Leather Belting, by C. O. Streeter, mechanical engineer, Graton & Knight Manufacturing Co. The same program was given Thursday and Friday with the substitution of Dr. R. R. Tatnall, chief engineer, J. E. Rhoads and Sons, in place of J. E. Rhoads in the discussion of How a Belt Transmits Power.

Locomotives for the Polish Railways

According to a report recently received, the Polish Railway Administration has placed orders for 25 locomotives in the United States and 20 locomotives in Switzerland, aggregating $900,000. Further orders have also been placed during the last few days with Austrian works. The latter are for locomotives of a lighter type and will be used on the Galician sections of the State Railways.

The Polish Government has also placed an order for 150 big tank cars with the French Arbel Works.

Business Items

The Manufacturers' Polishing and Platers' Supply Co., of Bridgeport, Conn., incorporated the past week, to manufacture polishing and platers' supplies, buffing tools, etc., has taken a lease on 6,000 square feet of floor space in a portion of the old Morris Metal Goods Co. plant on Union Ave., that city, and plan to begin operations Dec. 1.

The Perry Laundry Machinery Co., of Fairhaven, Mass., has incorporated under the laws of Massachusetts, to manufacture laundry and other machinery, etc., The capital stock is $100,000, and the incorporators are: Frank Vera, Emanuel J. Perry, 1352 Rockdale Ave., New Bedford, Mass., and M. V. Sequeria. Mr. Vera has been chosen president, and Mr. Perry is the treasurer of the company.

The Guy Steel Casting Co., Elmwood, a suburb of Hartford, Conn., has, during the past week, filed a certificate of dissolution with the Secretary of the State of Connecticut. The firm has decided to cease business, and claims may be sent to Mr. George B. Kinghorn, 776 New Britain Ave., Hartford, Conn. The company made steel castings, etc.

The Acme Shear Company, Bridgeport, Conn., large manufacturers of shears, cutters, etc., has recently increased the capital stock of the concern from $500,000 to $1,000,000. A certificate to that effect was filed during the present week with the Secretary of the State of Connecticut.

The Moore Drop Forging Co., Springfield, Mass.; is about to build a new machine shop to be located close to the drop forging plant. It is to be 93 x 35, one story and will cost $20,000. McClintock & Craig of Springfield are the architects and L. S. Wood has the building contract.

The Dominion Wheel and Foundries Co., Toronto, has recently acquired the plant at Cobourg, Can., formerly occupied by the Crossen Car Co., in which it is making brake shoes and general castings.

The Alloy Steel Castings Co., the plant of which is located at Levittsburg, Pa., has been granted authority at Columbus, Ohio, to increase its capital stock in the amount of $300,000, making its total capitalization $450,000. O. R. Grimmesey, treasurer of the com-

pany, says that the increase will augment the company's output approximately 100 per cent.

The Hykon Manufacturing Co., Canton, Ohio, manufacturer of automobile and electrical tools, suffered a loss from fire during the the past week estimated at $9,000.

The Premier Manufacturing Co., of Sandy Hook, Conn., manufacturer of electric, gas and water instruments, has, during the past week, acquired the business of the W. & B. Douglas Co., Middletown, Conn., manufacturer of pumps and equipment since 1832. The same firm has also acquired the business of the Standard Metal Work Corporation, of Thompsonville, Conn., manufacturer of sheet metal parts, etc. Charles H. Cole, president of the Premier Co., states that the concern will probably have a capital stock of about $1,500,000, and that the general office of the companies will be removed to Middletown, using the Douglas plant as main headquarters. The other plants will still be in operation and they will continue to make the various articles as heretofore.

The Locomobile Co. of America at Bridgeport, Conn., by order of Referee Keogh, has been formally transferred to the trustees of the new Locomobile Co. of America, a new York corporation, controlled by W. C. Durant.

The General Motors Corporation estimates that 1922 sales will aggregate 468,355 motor vehicles. In the first three-quarters of the year 316,136 cars and trucks were produced.

The Hayes Wheel Co. of Canada, Ltd., recently purchased the plant of the General Forgings and Stampings, Ltd., at Meriton, Can., and will equip it to produce automobile rims.

The Apex Tool and Stamping Co., 4830 Southern Parkway, Louisville Ky., has been organized recently to manufacture tools and stamped metal goods.

The National Forge and Tool Co., Irvine, Pa., is planning to increase its manufacturing facilities by installation of additional equipment.

The Mid-City Railroad Co. has been incorporated at Haines City, Fla., with $250,000 capital, and plans construction and operation of a line between Haines City and Polk City, fifteen miles, and a later forty mile extension to Clermont, Fla., thence to Dade City, thirty-five miles. Isaac Van Horn is named president of the company.

The Broadfoot Iron Works, of Wilmington, N. C., according to W. G. Broadfoot, president, has under construction additional units representing total investment of about $200,000. The company conducts a business in boiler and general machine and welding work.

The Anderson Tractor Co., manufacturer, has been organized at Anderson, S. C., with $200,000 capital, by William S. Anderson and associates.

The Street Bros. Machine Works and the Patten Manufacturing Co., both of Chattanooga, and among the South's largest manufacturers of hoisting machinery, have consolidated under the name of the Street Brothers Machine Works, Inc., according to J. H. Street, who continues as president of the enlarged company. J. W. Burrell, sales manager of the Patten company, continues as sales manager of the merged company.

The H. H. Chase Co., has been organized at Jamestown, N. Y. by H. H. Chase, formerly superintendent of the Salisbury Axle Co., of that city. The company will manufacture handle lock socket wrenches.

The Moon Motor Car Co. reports net profits of $326,478 for the quarter ended Sept. 30.

The Monitor Controller Co., Baltimore, Md., manufacturer of the "Just Press a Button" system of automatic control for all motor-driven apparatus has recently established in the South a branch office at Birmingham, Ala.

The Instant Heat Device Co. has been incorporated at Miami, Fla., with $300,000 capital, to establish a plant for the manufacture of a recently invented quick heater. W. A. Brown, of Miami, heads the company.

Olmstead, Kent & Co., has been organized at Orlando, Fla., with $25,000 capital it is announced by Lucien L. Olmstead, of Orlando, the new company to handle machinery, machinery supplies and engineering supplies at wholesale and retail. Mr. Olmstead is president, Roscoe Kent, vice-president and Robert E. Duckworth, secretary and treasurer.

Sugg Brothers, of Carthage, N. C., machine shop operators, announce plans for the immediate construction of a large shop, which, including new machinery to be installed, will represent an investment of several thousand dollars.

The Kalman Steel Co., at Youngstown, Ohio, operating a reinforcing bar plant, is installing machinery that will increase its capacity 50 per cent, says Supt. West. Next year the company will add a unit 76 x 376, giving the local plant about double its present capacity. Announcement is made that the Kalman Steel Co. has taken over the Foughner Steel Co. of New York.

The Studebaker Corporation, in its report for the third quarter shows a total production of 87,951 cars as against 56,163 in 1921. The total production for 1922 is expected to be about 110,000.

The Roller-Smith Co., 233 Broadway, New York City, announces the appointment of the Electric Material Co. as its agent in the State of Washington and parts of Oregon and Idaho. The Electric Material Co. has recently opened an office in the Hinckley Building, Seattle, and will handle the Roller-Smith Co.'s lines of electrical instruments, circuit breakers and radio apparatus in that territory. The Seattle office is in charge of R. F. Robinson, formerly connected with the Western Electric Co., and the Pacific Telephone and Telegraph Co. The Electric Material Co.'s main office is at 589 Howard St., San Francisco, Calif., and it also has a branch office in the Title Insurance Building, in Los Angeles. Roller-Smith apparatus is handled by both of these offices as well as the Seattle office which means that the Electric Material Co. represents the Roller-Smith Co. along the entire Pacific Coast.

The McClain Co. has been incorporated at Portland, Me., to manufacture wood and metal working machinery and tools. The directors are Frank H. McClain, treasurer; Clark B. Dunton and Henry L. Cheney.

The Somerset Machine Co. has been incorporated at Skowhegan, Me., to manufacture and repair tools and machines, with a capital of $10,000. The directors are: President, Oscar Thompson of Skowhegan; treasurer, Wallace S. Clark, Skowhegan, and Frank C. Fellows of Brookline, Mass.

The Victor Tool Co., Waynesboro, Pa., announces the appointment of the J. F. Buhr Machine Tool Co., 7762 Dubois Ave., Detroit, Mich., to represent the entire line of Victor products in Eastern Michigan.

Personals

WILLIAM T. RAYNER, treasurer of the Gilbert & Barker Manufacturing Co., Springfield, Mass., sailed recently on a pleasure trip through the South American countries. Mr. Rayner expects to be in the South for several weeks.

A. SKIDMORE, for many years associated with the Ayer-O'Connell Manufacturing Co., of Meriden, Conn., has been chosen superintendent of the Manufacturers' Polishing and Platers Supply Co., recently incorporated and organized to manufacture platers' supplies, buffing tools, etc., of Bridgeport, Conn.

FREDERICK G. HUGHES, vice-president of the New Departure Manufacturing Co., Bristol, Conn., has been elected president of the Bristol Chamber of Commerce, and will assume the duties of that office immediately.

MITCHELL S. LITTLE, president of the M. S. Little Manufacturing Co., of Hartford, Conn., and affiliated with several other industrial companies of Hartford, and vicinity, was, during the past week, elected a director of the Ætna Life Insurance Co., of Hartford, filling a vacancy caused by the recent death of the Hon. Morgan Gardner Bulkeley, former Governor of Connecticut, and Ex-United States Senator.

F. F. ROHRER, assistant to the manager of both the power and railway departments of the Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., has been appointed general contract manager of that company. In his new appointment, which is effective immediately, Mr. Rohrer will be a member of the staff of W. S. Rugg, general sales manager.

PAUL M. LINCOLN, past president of the American Institute of Electrical Engineers, and for many years associated with the Westinghouse Electric and Manufacturing Co., has been appointed director of the School of Electrical Engineering in the College of Engineering, Cornell University, to succeed the late Professor Alexander Gray.

D. K. HUTCHCRAFT, formerly vice-president of the Indiana Air Pump Co., Indianapolis, and one of the leading authorities on air lift pumping, has been appointed district manager of the Chicago Pneumatic Tool Co.'s branch office recently established at Tulsa, Okla.

EARLE M. HAYES, formerly general manager of and for the past five years with Hunter & Havens, steel, iron and mill supply merchants, Bridgeport, Conn., has just been appointed general manager of steel sales of the American Tube and Stamping Co., Bridgeport, Conn.

EDWARD T. OLIVER has been appointed to represent the Victor Tool Co., Waynesboro, Pa., manufacturer of taps, die heads, reamer holders, etc., in the Northern Ohio territory. He will make his headquarters at 2031 Lincoln Ave., Lakewood, Cleveland, Ohio.

THOMAS K. GLENN, head of the Atlantic Steel Co., of Atlanta, for many years, and one of the best known iron and steel manufacturers in the southern field, has been named to the presidency of a new banking corporation formed in Atlanta this month by the consolidation of the Lowry National Bank and the Trust Company of Georgia.

H. H. GILDNER, formerly with the S K F organization in New York, has become associated with the Timken Roller Bearing Co. as district manager of sales in the Chicago territory.

JOHN H. PECKHAM, for many years connected with the Norton Grinding Co., Worcester, Mass., has now joined the selling department of Henry Prentiss and Co., New York. Mr. Peckham will act as grinding machine specialist for the sales and service ends.

D. W. PITCOCK, former superintendent of the Massillon Rolling Mill Co., Massillon, Ohio, has become general superintendent of the Universal Steel Co., at Bridgeville, Pa.

CHARLES B. WILSON, vice-president and general manager of the Willys-Overland Co., Toledo, Ohio, has resigned to return to Pontiac, Mich., as active president of the Wilson Foundry and Machine Co., of which he was president and general manager until his active affiliation with the Willys organization late in 1920.

WILLIAM H. WARREN, former general manager of the Gary plant of the Illinois Steel Co., and of the Brier Hill Steel Co., has been appointed general superintendent of the Trumbull Steel Co., at Warren, Ohio.

H. B. NEWTON, purchasing agent for the Thew Shovel Co., Lorain, Ohio, has been named to do the purchasing also for the Universal Crane Co., an affiliated company, Elyria. All the buying will be done at Lorain.

STANLEY B. MATHEWSON, factory manager of the old Elwood-Meyers Co., Springfield, Ohio, has resigned to become director of personnel of Antioch College, Yellow Springs, Ohio, succeeding H. L. Gardner, who has been made assistant to the general manager of the Shelton Looms, Shelton, Conn.

A. W. IRVING, formerly with the Holden Co. of Canada, has joined the sales organization of the Canadian Machinery Corporation, Toronto.

WILLIAM GAMBLE, formerly with the Moline Plow Co. at Poughkeepsie, N. Y., has been appointed purchasing agent of the Rock Island Plow Co., Rock Island, Ill.

J. W. LEROUX, of Atlanta, for several years southeastern representative of the Virginia Bridge and Iron Co., of Roanoke, Va., has resigned, effective Jan. 1, 1923, and will thereafter devote his entire time to industrial development work in the southern field. E. S. Humphries, of Roanoke, has been named to succeed Mr. Leroux.

COLONEL WILLIAM L. SCOTT, of Atlanta, for the past eight years sales manager in the southern territory for the Ohlen-Bishop Co., of Columbus, Ohio, and one of the South's best known machinery and saw men, has tendered his resignation to this company and accepted a similar position with the American Saw and Manufacturing Co., of Springfield, Mass. He will make his headquarters in Atlanta at 42 West Alabama St.

Obituary

WALTER M. SPAULDING, chairman of the board of directors of the Graton & Knight Manufacturing Co., Worcester, Mass., and identified with that company for more than 50 years, of which 13 years were as president, died at his home in that city, Nov. 16, aged 76 years. He retired as president last March.

MYRON E. REAM, vice-president of Leffingwell-Ream Co., management engineers, died suddenly November 17, in Chicago.

WILLIAM MAURER, 63 years old, prominent South Bend, Ind., manufacturer and owner of the Maurer Machine Works, died recently in that city.

JAMES BUTTERWORTH, retired manufacturer of textile machinery, died November 14, at his home, No. 252 Pelham Road, Mt. Airy, Philadelphia, Pa., aged 82 years. Born in that city, he entered the service of his father, head of the H. W. Butterworth & Sons' Co., in 1857, and was admitted to the firm in 1889. He was its president when he retired 10 years ago.

Book Reviews

Foreign Commercial Credits. By George W. Edwards, Assistant Professor of Banking, School of Business, Columbia University, and Research Assistant, Federal Reserve Board. Two hundred thirty-eight 6 x 9 in. pages, cloth boards. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York, N. Y. Price $2.50.

A welcome addition to our rather meager literature dealing with foreign trade. The United States, as a nation is probably less well founded in fundamentals of foreign trade than any other large nation, yet must realize that eventually she will engage extensively in that type of commerce. On that account this book, which takes up the letter of credit, the fundamental method of financing foreign trade for many years, should be of great value to those who wish to understand how to do business abroad. Practical and legal principles underlying the letter of credit are explained.

An introduction by H. Parker Willis is followed by chapters on the movement toward uniformity in commercial documents, present status of shipping documents meaning and classification of letters of credit, operation of letters of credit, travelers' letters of credit, the letter of credit in American law—principles, the letter of credit in American law—decisions, the authority to purchase, the trust receipt, British commercial credits, the letter of credit in British law, German commercal credits, commercial credit practice of Japanese banks, commercial credit practice of some continental banks.

There are appendices on commercial credit instruments, uniform commercial credit regulations of the commercial credit conference, the Hague rules, 1921, points of variance between the Hague rules and the Harter act, American foreign trade definitions, Diamond Alkali Export Corporation vs. Bourgeois.

Manchuria: Land of Opportunities. Published by the South Manchuria Railway, Dairen, Manchuria. Boards, 113 6 x 9 pages, 100 half tones, map and 10 charts.

This book tells the story of the amazing transformation that has taken place in Manchuria. The development of this country has been made possible by the South Manchuria Railway, with its American equipment, its coal and iron mines, steel works, electric plants and industrial works.

Known only a few years ago as "The Forbidden Provinces," this section of China has made almost unbelievable strides since the close of the Russo-Japanese War, when Russia's rights in the country were transferred to Japan. The traveler in Manchuria rides in a Pullman sleeping car, drawn by a Baldwin Locomotive over 100 lb. rails made in Pittsburgh.

Riding from the modern part of Dairen northward through cities lighted by electricity, with their fine railway stations, paved streets, hotels, schools, hospitals and scientific laboratories; past American equipped steel works, coal mines and factories, the transformation is so great that the traveller can hardly believe he is in a land which only a few years since was the home of the Manchu rulers of China and a forbidden land to world commerce.

The book is absorbingly interesting and gives one an insight into this almost unknown country that cannot be obtained from any history.

Fundamentals of Practical Mathematics. By George Wentworth, David Eugene Smith and Herbert Druery Harper. One hundred ninety-eight 5 x 7 in. pages, cloth boards. Illustrated. Published by Ginn & Co., 15 Ashburton Place, Boston 2, Mass. Price $1.20.

The authors divide the book into chapters on fundamental operations, ratio and proportion, mensuration, trigonometry, the slide rule, and general applications. From a consideration of those divisions it may be seen just what they include under "fundamentals."

There are two general points to be considered in any book, content and arrangement. Much praise may honestly be given to both in "Fundamentals of Practical Mathematics." Beginning with a review of addition, subtraction, multiplication and division of whole numbers, decimals and common fractions, the student is led by easy steps through elementary trigonometry, which is followed by a chapter on the slide rule.

Arrangement of the contents eliminates almost all inconvenience. Problems and the illustrations to which they refer are printed on facing pages. The first page after the table of contents contains an explanation of symbols. The last two pages of text consist of definitions of mechanical terms. Text dealing with trigonometry is followed by four-place tables of the natural functions. A feature of the book is that the line cuts are printed in blue, showing a white line on a blue background, in that way teaching the student how to read blue prints. As the problems refer to the cuts, the blue prints must be used constantly.

Problems of the type that the student will meet in his work have been selected. Mathematics is shown to be a practical subject, not merely one used to exercise the mind.

Motor Vehicle Engineering—The Chassis. By Ethelbert Favary, author of "Motor Vehicle Engineering—Engines." Four hundred sixty 6 x 9 in. pages, 515 illustrations, cloth boards. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York, N. Y. Price $5.00.

The author has attempted, and to the reviewer he seems to have very satisfactorily accomplished, the embodiment of information that may be applied by students, and those engaged, or wishing to become engaged, in the automotive industry, to actual work. For clarity in presentation the contents of such a book naturally fall into several divisions. In this book they deal with chassis layout, mechanics of materials, frames, clutches, shafts and universal joints, transmission or change speed gears, rear axles, rear axles for trucks, rear axle loads and stresses, torque arms, thrust-, radius-, and truss rods, brakes, front axles, steering gears and other subjects.

There is little of a historical nature about the book and it is in no sense merely a compilation of information showing present day practice. Underlying principles have been stated and explained clearly. Only elementary mathematics has been used. To quote from the preface, "The method pursued in the treatment of the subject is largely a result of the author's work as consulting engineer, his experience with draftsmen and designers and his lectures on motor vehicle design at Cooper Union to men engaged in the industry."

Machine Shop Mathematics. By George Wentworth, David Eugene Smith and Herbert Druery Harper. One hundred fifty-eight 5 x 7 in. pages, cloth boards, illustrated. Published by Ginn & Co., 15 Ashburton Place, Boston 2, Mass. Price $1.20.

The second book of a series (the first is "Fundamentals of Practical Mathematics," reviewed in American Machinist, page 868c). The purpose of the book, the authors declare, is "to meet the needs of students who expect to become machinists, either in the special line of automobile construction or in the more general lines.

Measuring Instruments is the title of the first chapter. It is followed by chapters on speeds and feeds, tapers and taper turning, screw threads, indexing and spiral cutting, gears, review problems. Reference tables include tables of measures, decimal equivalents, natural trigonometric functions, powers and roots, sizes of twist drills with decimal equivalents, speeds of drills, sizes of screw threads and tap drills, and others. The problems are thoroughly practical and well presented.

1922 Year Book of the Merchants Association of New York. Published by the Association. Paper cover; 328 pages with index.

The book is a complete record of the activities of the Association. It contains a list of the complete executive personnel, the make-up of its various departments, their functions and duties, reports of the various officers for the past year and the names of the members of the association.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Machine for making cement blocks—Mexico. Purchase desired. Quotations, f.o.b. New York or New Orleans. Payment, cash. Reference No. 4296.

Clay working machinery suitable for making pottery, fancy tiles and particularly electric porcelains, and also glazing material of various colors for the above articles—China. Purchase desired. Quotations, c.i.f. Chinese port. Reference No. 4277.

Batteries and magnetos for motor cars, lighting, etc.—South Africa. Purchase and agency desired. Quotations, f.o.b. New York. Payment to be made in New York. Reference No. 4278.

Seamless solid drawn steel tubes from ½ to 12 inches in diameter—Scotland. Purchase desired. Quotations, c.i.f. Scottish port. Terms: Payment against documents. Reference No. 4279.

Machines to make twisted-wire brushes of all kinds—Canada. Purchase desired. Payment, cash. Reference No. 4281.

A pneumatic metal sprayer for use in spraying zinc, tin, copper, nickel and other metals on cast iron, etc.—Norway. Purchase desired. Quotations, f.o.b. New York. Reference No. 4291.

Electrical goods and equipment of every kind, household and building hardware and agricultural implements—Ireland. Agency desired. Quotations, c.i.f. Dublin. Reference No. 4338.

A rotating or circular shearing machine —France. Purchase desired. Quotations, c.i.f. French port. Terms, cash with order. Correspondence, French. Reference No. 4255.

Machinery for the manufacturing and polishing of all types of lamp reflectors—England. Quotations, c.i.f. English port. Terms, cash against documents. Reference No. 4257.

Wire nails, cut nails, machine screws, wood screws, hinges, steel latches, sandpaper and waterproof and casein glue—Switzerland. Purchase desired. Quotations, c.i.f. Antwerp. Payment, cash in advance. Reference No. 4265.

Wire rods and steel plates—England. Purchase or agency desired. Quotations, f.o.b. New York. Reference No. 4273.

Machinery and tools for the equipment of a factory to turn out 200 clocks per day, and also machinery for the manufacture of metal and wooden clock cases—India. Everything except springs to be manufactured in factory. Purchase desired. Quotations, c.i.f. port of India. Reference No. 4342.

Agricultural machines, tractors, automobiles (lighter and cheaper cars), motor trucks (1½ to 3 tons), and motors of various descriptions—Baltic Provinces. Purchase and agency desired. Quotations, c.i.f. Baltic port. Correspondence, German. Reference No. 4350.

Motor cars, motor cycles and accessories, spares and tools of every description—India. Purchase and agency desired. Quotations, f.o.b. New York. Reference No. 4352.

One hundred copper steam tubings, each of 5 meters in length, diameter 70 millimeters, and thickness 2 millimeters—Greece. Purchase desired. Quotations, f.o.b. New York. Payment arranged by confirmed letter of credit in New York. Reference No. 4353.

All sorts of radio-telegraphic apparatus and precise measuring instruments for radio laboratories, such as amperemeters and voltmeters—Czecho-Slovakia. Catalogues and price lists are desired. Reference No. 4354.

Plant for the development of power facilities, or equipment for the extension of existing electric light plant through the agency of crude oil engines or water—Canada. Purchase desired. Quotations, literature and catalogues requested. Reference No. 4355.

Mechanical specialties and specialties of all kinds (excepting automobile accessories), and also general merchandise of all kinds—South Africa. Inquirer is in the United States for a short time for the purpose of securing agencies. Reference No. 4360.

Machinery for the equipment of a factory for the manufacture of cork products—Italy. Purchase desired. Quotations, c.i.f. Italian port. Payment: Cash against documents. Reference No. 4361.

Galvanized sheets, 1 by 2 meters, in two thicknesses, 0.55 and 0.65 millimeter—Switzerland. Purchase desired. Quotations, c.i.f. Antwerp. Terms: Cash. Reference No. 4363.

Solution for removing rust or for loosening rusted screws and bolts—Italy. Purchase desired. Quotations, c.i.f. Italian port. Payment: Cash. Reference No. 4368.

Agricultural implements and machinery —Japan. Purchase and agency desired. Quotations, c.i.f. Kobe or Yokohama. Terms: Payment against documents. Reference No. 4370.

Electrical goods of all kinds, labor-saving machinery, machine tools, rubber belting, rubber hose, metals, rails and novelties in the engineering line—Sweden. Agency desired. Quotations, f.o.b. New York. Reference No. 4371.

Electrical apparatus of all sorts and machinery in general—Spain. Agency desired. Terms: Payment upon receipt of merchandise. Correspondence, Spanish. Reference No. 4372.

Large machine for the reconditioning of worn and flattened electric car wheels—Spain. Purchase desired by railway company. Quotations, c.i.f. Spanish port. Terms: Cash on delivery of machinery. Correspondence, Spanish or French. Reference No. 4385.

Refractories—Italy. Purchase desired by manufacturer. Quotations, c.i.f. Italian port. Reference No. 4386.

Trade Catalogs

Gear Grinding. The Lees-Bradner Co., Cleveland, Ohio. This company has just issued a new publication of sixteen pages, with an attractive arrangement, on the subject of gear grinding. The publication features the Lees-Bradner product in the line of grinders for this work and contains eleven selected illustrations. It sets forth in detail a quantity of output process that finishes spur gears after hardening, maintaining standards of accuracy and quietness in the product. A feature of the publication is the discussion of the principles of the involute curve, the development of the involute tooth, proving the involute principle and the rack form and the process of generating gear teeth of this type on the Lees-Bradner machines. The illustrations show not only the general assembly of the grinders but give details of construction as well.

Flexible Shaft Applications. The S. S. White Dental Manufacturing Co., Philadelphia, Pa. A new sixteen-page publication just issued by this company is entitled "From Sheep Shears to Speedometers and Other Applications of the Flexible Shaft. It is a general review of the progress made in recent years of the development of flexible shafts by this company, tells how they are made and sets forth their many uses in numerous industries.

Brown Pyrometers. The Brown Instrument Co., Philadelphia, Pa. This company has just issued a new folder featuring the Brown method of automatic temperature control on furnaces in shops, etc., for hardening and tempering tools.

Portable Undercutting Equipment. The S. S. White Dental Manufacturing Co., Philadelphia, Pa. A new four-page folder just issued by this company illustrates and describes its portable undercutting equipment, handpieces and flexible shafts designed especially for cutting down the mica between commutation segments.

War Surplus. The U. S. War Department, Director of Sales, has just issued a small pamphlet describing, in a general way, the methods of sale resorted to by the Department in the disposal of its stocks of surplus property. The pamphlet tells what these stocks consist of and contains a loose-leaf insert listing the dates of the important sales scheduled for the near future.

General Electric Catalog for 1921. The General Electric Co., Schenectady, N. Y. The company has just issued its general catalog for 1921, of 1338 pages with a catalog number index and a subject index. The catalog gives a representative listing of the company's products obtainable through its sales offices and distributors, all of which are given. The information on supplies also includes identification for ordering and, in most cases, prices also. The catalog supersedes all previous publications.

Power Punching Presses. The Niagara Machine and Tool Workers, Buffalo, N. Y. The company has just issued Bulletin No. 61 of twenty-four pages on its line of power punching presses, series Nos. 30-40-110. The bulletin is fully illustrated with views of the various types of machines and contains cuts showing construction details as well as specifications on each style and size.

Commercial Rust Remover and Pickling Compound. Peter A. Frasse and Co., Inc., 417 Canal St., New York City. This company has just issued a folder describing a new compound for the removal of rust.

Forthcoming Meetings

Eighteenth Annual Automobile Salon. Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention, December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

American Institute of Weights and Measures, annual meeting December 8, 1922, United Engineering Societies' Building, 29 West 39th St., New York City. Chas. C. Stutz, 115 Broadway, New York City, is secretary.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago, is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

American Society for Testing Materials, Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

New and Enlarged Shops

Machine Tools Wanted

Ill., Chicago — Monighan Machine Co., 2030 Carroll Ave.—slotting machine with 24 in. stroke and 36 in. clearance from center of table to housing.

Ill., Chicago—E. H. Stafford Mfg. Co., 218 South Wabash Ave. (manufacturer of furniture)—factory trucks, edge sanding machines and radial boring machines.

Ind., Newcastle—Goodwin Auto Co., J. Goodwin, Proprietor—machinery, tools and equipment for 2 story garage and service works on Race St.

Mass., Charlestown (Boston P. O.)—General Baking Co., Bunker Hill St.—equipment for proposed $100,000 garage on Ferrin St.

Mass., Roxbury (Boston P. O.) — B. White, 44 Holworthy St.—machinery and tools for garage.

Mo., St. Louis—J. Segal, 1231 Market St.—tools, motor and machinery for machine shop (used).

N. Y., Brooklyn—Metropolitan Mechanical Wks., 129 Boerum Pl.—one bench lathe.

N. Y., Buffalo—L. Feldstein, 2022 Seneca St.—machinery and equipment for garage and service station.

N. Y., Buffalo—Genesee Arcade, Inc., 1446 Genesee St.—mechanical equipment for $40,000 garage and service station.

N. Y., Buffalo—A. Korpalski, 1673 Bway.—two 1,000 gal. gas tanks and pumps, also other equipment for service station.

N. Y., Buffalo — M. & M. Oil Co., 20 Breckenridge St.—1,000 gal. gas tank and pump, also other equipment for service station on Huron and Oak Sts.

N. Y., Hamlin—H. E. Lewis—one power driven cutting machine.

N. Y., Rochester—Cullinan-Malcolm Co., Inc., 4322 Lake Ave.—equipment for gasoline and automobile service station.

Pa., Phila.—C. Crowley, Wildey St. and Montgomery Ave. (machinist)—additional machinery for new factory.

Pa., Phila.—Edward Wilkie Motor Co., 917 North Broad St.—machine shop equipment for sales and service station.

Wis., Kenosha—W. Russell, 603 Milwaukee Ave.—automobile repair machinery for proposed $40,000 garage.

Wis., Milwaukee—M. S. Mann., 1219 Holton St.—equipment, including gasoline tank and pump, for proposed $40,000 garage on 4th St.

Ont., Ford—Ford Motor Co. of Canada—equipment for machine shop additions.

Que., Montreal—Menard Garage, 223 St. Ambroise St., M. Menard, Purch. Agt.—lathe and other equipment for garage and repair shop.

Machinery Wanted

Ala., Alco (Brewton P. O.)—Alco Coal Co., F. Rice, Genl. Mgr.—electrical hoisting and mining machinery.

Ala., Wetumpka—J. F. Godard—planing mill, hardwood and veneer mill machinery.

Calif., San Francisco — San Francisco Chronicle, Chronicle Bldg., M. D. DeYoung, owner—equipment for proposed newspaper plant on 5th and Mission Sts.

Calif., San Francisco—Talbot Investment Co., c/o J. E. Kraft & Sons, Archts., Phelan Bldg.—traveling cranes, monorail system, spiral chutes, etc., for proposed warehouse on 8th and Natoma Sts.

Colo., Alamosa—Alamosa Journal—12 x 18 in. job printing press for power equipment.

Colo., Denver—Blaney-Murphy Co., Stock Yards, L. B. Hill, Purch. Agt.—machinery for proposed packing plant on 48th and Gilpin Sts.

Conn., Stafford Springs — Cyril Johnson Woolen Co.—machinery for addition to woolen mill.

Conn., Union City (Naugatuck P.O.)—J. Broderick, 117 Woodbine St. (woolen goods)—two 20 x 60 in. Garnett machines, one Kitson lapping machine, one baling press, one 36 in. jute picker (used).

D. C., Wash.—Bureau of Yards & Docks, Navy Dept., Spec. 4755—electric elevator cranes for Navy Yard, Puget Sound, Wash.

D. C., Wash.—C. R. Forbes, Dir. United States Veterans' Bureau, Arlington Bldg., will receive bids until Dec. 18 for laundry equipment and refrigerating machinery for U. S. Veterans' Hospital at Livermore, Calif.

Ill., Chicago—Chicago Metallic Mfg. Co., 542 West 35th St.—air compressors, hangers, shafting, pulleys and belting.

Ind., Bourbon—News-Minor—7 column newspaper press.

Ind., Warsaw—J. A. Dalton Co.—foundry equipment to replace that which was destroyed by fire.

Ia., Davenport—Linograph Co., Front and Scott Sts.—8 x 12 in. or 10 x 15 in. job press for power equipment.

Ky., Paducah—Paducah Ice Co.—refrigeration machinery and equipment for proposed addition to ice manufacturing plant.

Mass., Brockton—Lapworth Webbing Co., Sumner St.—machinery for addition to factory.

Mass., Clinton—Lancaster Mills, 1 Green St., (manufacturer of ginghams)—machinery for addition to mill.

Mass., Holyoke—J. Wisly, 18 Hitchcock St.—offset press and miscellaneous accessories for proposed addition to printing plant.

Mass., Roxbury (Boston P. O.)—E. Howard Clock Co., 206 Eustis St.—machinery for addition to plant.

Mich., Grand Rapids—Grand Rapids Wire Frame Co., 1719 Elizabeth Ave.—complete spot welder (used).

Minn., Minneapolis—Bd. Educ., 305 City Hall, F. S. Gram, Purch. Agt.—receiving bids until Dec. 4 for woodworking, refrigerating and sheet metal working machinery for Lincoln and Bryant Junior High Schools.

Mo., Bolivar—Stiles Mfg. Co., H. West, Pres.—steel lathe, drills, hack saws, cutoff saws, etc., for foundry and wood working factory, for the manufacture of gravel and coal loaders, etc.

Mo., Bowling Green—Printer, Box 42—complete equipment for job printing, including linotype, paper cutter, job press, hangers and pulleys (used).

Mo., Kansas City—B. & H. Auto Livery Co., 1026 Wyandotte St.—welding machinery and outfit, also power emery wheel, belting, hangers and pulleys.

Mo., Purdy—Review—job printing press, newspaper press and full equipment.

Mo., St. Louis—Haynes-Langenberg Mfg. Co., 4045-57 Forest Park Blvd. (manufacturer of furnaces)—one 20 hp. spot welder and two 20 hp. arc welders.

N. J., Hammonton—Littlefield Ice & Coal Co., A. Littlefield, Purch. Agt.—refrigerating machines, stills and conveyors for ice and cold storage plant.

N. J., Millville—Taubel, Scott & Kitzmiller Co., Millville and Riverside (manufacturer of textiles)—additional ribbers, loopers and latch needle machines for new mill.

N. Y., Buffalo—J. F. Endres—795 East Delevan Ave.—equipment for bakery at 407 Leroy Ave.

N. Y., Buffalo—K. Ostrowski, 19 Sunnyside Ave.—machinery and equipment for the manufacture of soft drinks.

N. Y., Buffalo—Williams Gold Refining Co., 2978 Main St.—equipment for proposed addition to factory.

N. Y., Jamestown—Clarke Baking Co., 809 North Main St.—bakeshop equipment to replace that which was destroyed by fire.

N. Y., Jamestown—New Ice & Coal Co., 925 Clinton St.—refrigeration machinery for proposed ice manufacturing plant.

N. Y., Philmont—Columbine Garment Co. (manufacturer of wearing apparel)—baling press, folding and measuring machine and cloth cutting machinery.

N. Y., Rochester—J. Lockhart, 979 Harvard St.—machinery and equipment for the manufacture of picture frames, for factory on Elwood Ave.

N. Y., Rochester—M. Michael, 71 North Water St.—bandsaw, swing saw, variety saw, jointer and pony planer.

N. Y., Rochester—Standard Oil Co. of New York, 312 Wilder Bldg.—tools and equipment for gasoline station on North Clinton Ave.

N. Y., South Dayton — Mohawk Condensed Milk Co.—machinery and equipment for the manufacture of evaporated milk.

N. Y., Wellsville—Andover Silk Weaving Corp., South Main St.—60 silk weaving looms and other equipment for silk mill.

N. Y., Westfield—Welch Grape Juice Co., Welch Bldg.—machinery and equipment for grape juice plant at Springdale, Ark.

O., Columbus — Columbus Sheet Metal Wks., Lynn and Ludlow Sts., O. C. Hearing, Proprietor—new sheet metal working equipment, including breaker, slotter, etc.

O., Columbus—Modern Woodworking Co., 476 South High St., C. F. Biederman, Purch. Agt.—one sticker, one double cutoff saw, one double spindle shaper and one tenon machine.

O., Greenville—Allied Belting Co.—looms and other equipment for weaving cotton duck into belting.

O., London—Williams Co. (manufacturer of steel wool)—machinery and equipment for addition to factory.

O., Springfield—Fairbanks Piano Plate Co., Kenton St.—equipment for factory to replace that which was destroyed by fire.

Pa., Bridesburg (Phila. P. O.)—Abrasive Co., Tacony and Fraley Sts. (emery and other products)—additional metal working machinery, cloth and paper coating machines, also machinery to work abrasives, etc.

Pa., Erie—The Northwestern Motors Co., 21st and State Sts.—machinery and equipment for factory to replace that which was recently destroyed by fire.

Pa., Glassmere—Allegheny Plate Glass Co.—machinery and equipment for $100,000 addition to glass factory.

Pa., Johnstown—Edward Hahn Packing Co., Hickory St. and Baltimore & Ohio R.R.—trolley conveying system and ice machines.

Pa., Johnstown—National Radiator Co., Central Ave. and Ohio St., S. Moore, Genl. Mgr.—one electric overhead crane.

Pa., Lebanon—J. Warren Light—machinery and equipment for the manufacture of machine screws and similar products.

Pa., Manyunk (Phila. P. O.)—R. Krook, Main St. (manufacturer of carpet yarns, rugs, etc.)—additional sets, mule spindles, etc.

Pa., Norristown—Ballard Knitting Co.—10 x 12 in. Wildman body machines with revolving cylinders.

Pa., Norristown—Bd. Educ.—vocational equipment for $250,000 junior high school.

Pa., Phila.—Commercial Truck Co., 27th and Brown St.—one No. 3 Nazel air hammer.

Pa., Phila.—M. Dam, 7205 Buist Ave. (electro plating)—rumbling barrels, plating dynamo, wood plating tank, steel tank, polishing machines, etc.

Pa., Phila.—H. J. O'Donnell, 6106 Vine St. (tinners and sheet metal works)—one set of 30 in. and one set of 36 in. rollers, one turning machine, one folder, tinners' tools, etc.

Pa., Phila.—Paper Mfg. Co., 562 Cherry St.—machinery for the manufacture of paper, also belting, pulleys, etc., for new factory.

Pa., Phila.—Pennsylvania R.R. Co., 17th and Filbert Sts., M. Smith, Purch. Agt.—1,500 lb. steam hammer.

Pa., Pittsburgh—Pittsburgh Stencil & Tool Co., 40 Water St.—metal cutting band saw.

Pa., Swarthmore—E. F. Woodhead—machinery and equipment for the manufacture of paper products.

Pa., Wayne—Bd. Educ., F. Seaggs, Secy.—vocational equipment for proposed high school.

R. I., Woonsocket — Fairmont Worsted Co., 18 Worrall St., J. F. Sweeney, Purch.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Steel bars quoted at $2.10 per 100 lb., f.o.b. Pittsburgh, for delivery in first quarter of 1923. Aluminum ingots, ton lots, advanced 2½c. per lb. during week; following rise of 2c. per lb. for the week preceding.

Declines—Although shapes, plates and bars are holding to the $2 level, some mills have shown willingness to cut under this price, to the extent of $1@$2 per ton, f.o.b. mill. Plates have been shaded to $1.85@$1.90 for special lots of 1,000 tons or more. Pig-iron market remains weak, with improvement in coke production and the car supply. Tin plate orices remain unchanged. This item represents the only steel product which did not advance in the general market rise, started last spring. Zinc quoted in New York warehouses at 7½c. as against 7⅝c. per lb., last week. Lead, quiet; down ⅛c. per lb. in East St. Louis. Linseed oil, f.o.b. New York, 90c. as compared with 93c. per gal., one week ago. Lard oils quiet without change in price. No improvement in demand for lubricants.

IRON AND STEEL

PIG IRON—Per gross ton—Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$28.55
Northern Basic	31.27
Southern Ohio No. 2	31.71
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	33.27
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	31.14
Virginia No. 2	37.17
Basic	28.26
Grey Forge	29.64
CHICAGO	
No. 2 Foundry local	30.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	31.50
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	28.50
Basic	28.00
Bessemer	31.00

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.60	4.19	3.70	4.00
No. 12	2.60@2.70	4.24	3.75	4.05
No. 14	2.70@2.75	4.29	3.80	4.10
No. 16	2.90@3.05	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized				
Nos. 10 and 11.	3.35@3.50	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.60	5.00	4.50	4.95
Nos. 17 and 21.	3.75@3.90	5.30	4.80	....
Nos. 22 and 24.	3.90@4.05	5.45	4.95	5.45
No. 26	4.05@4.20	5.60	5.10	5.55
No. 28	4.35@4.50	5.90	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
3/32	8.00		12@13
1/8	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.25
Tin, 5-ton lots, New York	36.87½
Lead (up to carlots), St. Louis 6.85@6.90; New York	7.50
Zinc (up to carlots), St. Louis 6.95@7.00; New York	7.50

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.50	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.75	9.25
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	6.50	6.75	7.00
Zinc	3 00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½	\$0.12	\$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13¾, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.90	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville...per net ton		\$6.75@7.25	
Coke, prompt foundry, Connellsville...per net ton		7.50@8.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	\$6.00	\$3.50	\$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	\$5.00	\$3.90	\$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.60	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

Agt.—one narrow pattern loom, one jack spool winder and one single spooling machine (used).

Tenn., Memphis — Stryker Kot-N-Wood Co., 1040 Oakland Ave.—machinery and equipment for $65,000 plant, for the manufacture of building specialties.

Tex., Ennis—News—7 column fast newspaper press.

W. Va., Wheeling—Wheeling Box Co., 3007 Chaplin St.—automatic cut saw, rip saw and belting.

Wis., Beloit—T. B. Goodall, 433 Broad St.—oil storage tanks and pumps for proposed filling station.

Wis., Clinton—Robert Work & Co., Inc., F. W. Herron, Vice Pres.—machinery and equipment for the manufacture of septic and storage tanks, chemical toilets and sanitation systems.

Wis., Fond du Lac—Gurney Refrigerator Co., 64 South Brook St., E. G. Vail, Pres.—machinery for the manufacture of refrigerators, also machinery for power plant.

Wis., Jackson—Jackson Canning Co., M. Gardiner, Mgr.—electric power machinery for proposed canning factory.

Wis., Janesville—Janesville Caloric Co., F. M. Coyle, Genl. Supt.—machinery, tools and equipment for the manufacture of electric fireless cookers.

Wis., Milwaukee — Milwaukee - Western Fuel Co., 120 Wisconsin St.—chain hoist for proposed repair shop on Clinton St.

Wis., Milwaukee—J. M. Nash, 842 30th St.—woodworking machinery.

Wis., Milwaukee—Wisconsin Ice & Coal Co., 216 West Water St.—ice making machinery for proposed plant on 31st and Galena Sts.

Wis., New London—Wisconsin Cabinet & Panel Co., J. H. McLaughlin, Mgr.—power machinery for proposed box factory.

Wis., Port Washington—Hansen Canning Machine Co.—machinery for the manufacture of special vegetable canning machines for proposed factory at Cedarburg.

Wis., Prairie du Chien—Prairie du Chien Tool Co.—machinery and equipment for the manufacture of wrenches, tools and automotive specialties.

Wis., Sheboygan — Vollrath Co., West Michigan Ave., D. F. Riess, Secy.—special machinery for proposed enameling factory, including annealing and stamping room.

Wis., Waupun — Althouse-Wheeler Co., H. O. Thompson, Mgr.—machinery for the manufacture of wind mills, steel towers, tanks, etc.

Wis., Wisconsin Rapids—Prentiss-Wabers Co.—enameling and special machinery for the manufacture of heating devices.

Ont., Oshawa—Phillips Mfg. Co. (manufacturer of picture moldings, frames, etc.)—machinery and equipment for addition to plant.

Ont., Welland—Welland Packing Co., Ltd.—several thousand dollars worth of machinery for proposed plant at Niagara Falls.

Metal Working Shops

Calif., San Francisco—The Amalgamated Laundries, 8th and Harrison Sts., awarded the contract for the construction of a 1 story garage. Estimated cost $40,000.

Calif., San Francisco — A. S. Bugbee, Archt., 26 Montgomery St., is receiving bids for the construction of a 2 story garage on Sacramento St. near Polk St., for L. R. Lurie, Mills Bldg. Estimated cost $54,000. Noted Nov. 16.

Calif., San Francisco—The Simmons Co., 198 Bay St., manufacturer of metal furniture, beds, etc., awarded the contract for the construction of a 3 story factory and warehouse on Powell and Bay Sts. Estimated cost $250,000.

Calif., San Francisco—The Star Garage Co., 150 Turk St., is having plans prepared for the construction of a 2 story addition to its garage. Estimated cost $60,000. J. L. Stewart, Claus Spreckels Bldg., Archt.

Calif., Watsonville — Watsonville Union High School Dist. awarded the contract for the construction of a machine shop. Estimated cost $5,693. Noted Nov. 9.

Conn., Bridgeport—The Locomobile Co. of America, Inc., 2 Main St., manufacturer of automobiles and trucks, awarded the contract for alterations, and for the construction of a 1 story, 60 x 180 ft. and 40 x 200 ft. additions to its machine shop.

Conn., Hartford—Kaplan & Goldberg, 32 John St., will build a 1 story, 90 x 100 ft. garage and service station. Estimated cost $40,000.

Conn., Torrington—The Union Hardware Co., Mignon Ave., plans to build a 3 story addition to its plant. Estimated cost $50,000. Architect not announced.

Ill., Chicago—The Advance Fdry. & Pattern Co., 2734 West 36th St., awarded the contract for the construction of a 1 and 2 story, 55 x 142 ft. addition to its factory. Estimated cost $50,000. Noted Oct. 19.

Ill., Chicago — Voightmann & Co., 445 West Erie St., manufacturer of metal windows, awarded the contract for the construction of a 1 story, 280 x 300 ft. factory at 4158 Schubert Ave. Estimated cost $150,000.

Ind., Warsaw—The J. A. Dalton Co. plans to rebuild portion of its foundry which was destroyed by fire. Estimated cost $15,000. Architect not announced.

Ky., Louisville—The Mengel Body Co. is having plans prepared for the construction of an automobile body plant on a 30 acre site on 4th and G Sts. Joseph & Joseph, Francis Bldg., Archts.

Mass., Boston—The Boston Flower Exchange, Inc., 1 Winthrop Sq., awarded the contract for the construction of a 2 story, 135 x 200 ft. garage and mercantile building at 541 Tremont St. Estimated cost $80,000.

Mass., Charlestown (Boston P. O.)—The General Baking Co., Bunker Hill St., awarded the contract for the construction of a 2 story garage on Ferrin St. Estimated cost $100,000.

Mass., West Lynn (Lynn P. O.)—The General Electric Co. will build a 4 story 122 x 157 ft. addition to its factory. Estimated cost $200,000. Noted Sept. 14.

Mich., Holland—The Federal Mfg. Co. is building a plant for the manufacture of warm air furnace accessories (pressed steel). Cost between $60,000 and $100,000.

Mo., Bolivar—The Stiles Mfg. Co. is having plans prepared for the construction of a 46 x 106 ft. foundry and wood working factory, for the manufacture of gravel and coal loaders, etc. Estimated cost $5,000. H. West, Pres. E. Stiles, Aldrich, Engr.

Mo., Webster Groves—The Texas Oil Co., Houston, Tex., awarded the contract for the construction of a 1 story, 40 x 170 ft. garage on Forsythe Ave., here. Estimated cost $40,000.

General Manufacturing

Ind., Hartford City—The Fort Wayne Corrugated Paper Co., Murray and Barr Sts., Fort Wayne, is having plans prepared for the construction of a 1 to 2 story plant for the manufacture of paper, here. Estimated cost $70,000. Mills, Rhines, Bellman & Nordhoff, Ohio Bldg., Toledo, Ohio, Archts.

Ia., Davenport—The Linwood Stone & Cement Co., 713 Kohl Bldg., plans to build a cement plant, capacity 2,000 bbl. per day. Estimated cost $1,500,000. Architect not selected.

Mass., Fitchburg—The Star Worsted Co., manufacturer of Bradford spun worsted yarns, will soon receive bids for the construction of a 5 story addition to its mill, to contain about 40,000 sq.ft. of floor space, to be used for combing, drawing and spinning. Lockwood, Greene & Co., 24 Federal St., Boston, Engrs.

Mass., New Bedford — The Hathaway Mfg. Co., Front St., manufacturer of cotton goods, awarded the contract for the construction of a 1 story, 40 x 98 ft. addition to its mill and a 3 story, 25 x 40 ft. manufacturing building. Estimated cost $40,000.

Mich., Flat Rock—The Ford Motor Co., Highland Park, awarded the contract for the construction of a 1 and 2 story plate glass factory, here. Noted Nov. 2.

Mich., Muskegon—The Central Paper Co. awarded the contract for the construction of additions to its factory, consisting of a 3 story, 90 x 110 ft. warehouse, a 3 story, 55 x 300 ft. machine room and 3 story, 42 x 53 ft., 2 story, 45 x 150 ft. and 4 story, 46 x 90 ft. buildings. Estimated cost $200,000. Noted Nov. 9.

Neb., Fremont—The Fremont Mfg. Co. awarded the contract for the construction of 1 story, 60 x 84 ft., 112 x 140 ft., 56 x 140 ft., 40 x 188 ft. factory buildings for the manufacture of refrigerators, incubators, etc. Estimated cost $50,000.

N. Y., Binghamton — The Binghamton Gas Co., 40 Chenango St., plans to build a fuel oil and gas station, capacity 500,000 gal., on Court St. Estimated cost $10,000. C. Bennett, Genl. Mgr.

N. Y., Buffalo—The Island Warehouse Co., Ganson St. and Ship Canal, awarded the contract for the construction of a 10 story, 9 x 100 x 268 ft. flour mill. Estimated cost $500,000.

N. Y., New York—The Empire State Ice Co., 76 West Monroe St., Chicago, awarded the contract for the construction of a 3 story, 110 x 136 ft. ice making plant on 161st St. and Grant Ave., here. Estimated cost $135,000.

N. Y., Oswego—The Oswego Netherland Co. is having plans prepared for the construction of a 1 story, 100 x 365 ft. ice cream plant. Estimated cost $180,000. The McCormick Co., Inc., Century Bldg., Pittsburgh, Pa., Archts.

O., Ashland—The J. E. Matthews Produce Co. is having plans prepared for the construction of a 3 story, 60 x 75 ft. cold storage building with 15-ton ice making equipment. L. J. Goodrich, 207 East 4th St., Engr.

O., Columbus—The Doddington Co., 451 West Broad St., will build a 2 story, 60 x 100 ft. factory for mill work on Duerr Rd. Estimated cost $25,000.

Pa., Bethlehem—The Kurtz Furniture Co., plans to reconstruct its buildings 3, 4 and 5, which were recently destroyed by fire. Estimated cost $800,000. Architect not announced.

Pa., Clearfield—The Gingery Hardware Co. awarded the contract for the construction of a 3 story, 50 x 100 ft. store, warehouse and planing mill on 4th and Pine Sts. Estimated cost $40,000. D. Gingery, Pres.

Pa., Jeannette — The Amer. Window Glass Co., Farmers Bank Bldg., Pittsburgh, will soon award the contract for the construction of a 1 story, 40 x 828 ft. glass factory and cutting room, here. Estimated cost $175,000. L. J. Pierce, c/o owner, Engr. Private plans.

R. I., Woonsocket — The Rhode Island Knitting Co., Jeffers St., plans to build a 2 story addition to its knitting mill. Estimated cost $50,000. Private plans.

Va., Richmond — The Wortendyke Mfg. Co., foot of 13th St., manufacturer of paper products, has had sketches made for the construction of a 3 story factory. Estimated cost incl. machinery, $200,000. Carneal & Johnston, Chamber of Commerce Bldg., Archts.

W. Va., Fairmont—The Monongah Glass Co. awarded the contract for the construction of a 2 story, 36 x 103 ft. cooper shop and glass factory. Estimated cost $15,000.

W. Va., Huntington—The Carbocite Co., c/o S. J. Hyman, Day and Night Bank Bldg., plans to build a 1 story coal tar refining factory. Estimated cost $100,000. Architect not selected.

Wis., Antigo — The Langlade Creamery Co. will build a 2 story, 50 x 95 ft. bottling plant. Estimated cost $45,000.

Wis., Jackson—The Jackson Canning Co. awarded the contract for the construction of a 1 story, 24 x 30 ft. addition to its canning factory. Estimated cost $8,000.

Wis., La Crosse—The Weisse Mfg. Co., Caledonia and Gillett Sts., plans to build a 2 story, 50 x 100 ft. factory for the manufacture of millwork products. Estimated cost $50,000. J. Weisse, Pres. Architect not selected.

Wis., Madison — The J. Heilprin Fruit Co., West Mifflin St., plans to build a 2 story, 75 x 150 ft. cold storage warehouse on Bedford St. Estimated cost $90,000. J. Heilprin, Pres. Architect not selected.

Wis., Mayville — The Bd. Educ., A. Droeger, Secy., is having plans prepared for the construction of a 2 story, 112 x 274 ft. high school, including manual training plant. Estimated cost $250,000. Parkinson & Dockendorff, Linker Bldg., La Crosse, Archts.

Wis., Milwaukee—The Cedarburg Dairy Co., c/o H. Berns, 1586 Prospect Ave., is having plans prepared for the construction of a 1 story, 100 x 150 ft. dairy on 11th St. Estimated cost $75,000. H. J. Esser, 82 Wisconsin St., Archt.

Wis., Milwaukee—H. J. Esser, Engr. and Archt., 82 Wisconsin St., is receiving bids for the construction of a 4 story, 60 x 210 ft. and a 2 story, 60 x 210 ft. factory buildings for the Harsh-Chapline Shoe Co., 692 Hanover St.

Wis., South Milwaukee—The Pfister & Vogel Leather Co., 443 Virginia St., Milwaukee, awarded the contract for the construction of a 1 story, 63 x 66 ft. addition to its tannery, here. Estimated cost $25,000.

Ont., Chatham—Silverwoods, Ltd., London, is having plans prepared for the construction of a cold storage, ice cream and artificial ice plant. A. E. Silverwood, Mgr.

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Ordering and Storing Small Tools

Things to Do and to Avoid in Ordering Small Tools—Inspection and Storage Methods—Systems of Getting Tools to Workmen

By W. J. SANSOM

THE principal points to be considered in ordering the purchase of small tools are:

(1) The reasonable quantity that should be kept in stock, sufficient to meet ordinary demands. Careful estimating by the director will determine this and if a record has been kept of previous purchases on perpetual inventory cards or on the form shown in Fig. 1, the matter of the quantity required for a given period will have been well established.

RECORD OF TOOLS PURCHASED

Date of Reqn.	Manufactured by	Cost each	Quantity

FIG. 1—CARD FOR RECORDING TOOL PURCHASES

(2) What particular brand or make of tools has given the best satisfaction hitherto? The director should keep in touch with shop foremen on this point and keep notes for reference.

(3) Is the tool or appliance required of standard size, or is it special? If the tool is special, can changes be made on the part to be manufactured that will allow of stock sizes of tools being used? If the tool must be a special, then full details and, if necessary, a dimensioned sketch should accompany the order to the purchasing agent so that he may act with intelligence and the manufacturer may proceed without delay. Such sketches should be made with carbon duplicates as the retention of the duplicates may save a great deal of annoyance and expense.

(4) What will be the approximate cost of the tools? The superintendent is interested in costs and before he approves the requisition he should by all means know about the cost of the order.

The writer remembers a case where a tool director ordered a quantity of chasers for pipe threading machines and the order was sent to the manufacturer who discovered that it amounted to almost $1,000. This quantity being unusually large for the purchaser's needs, in the estimation of the manufacturer, an inquiry was sent to the purchaser regarding the order and, upon investigation, it was found that a $250 order would fill all requirements. If the purchaser had followed the plan of having the tool director state the approximate value of the order, the large amount of the order would have resulted in an investigation of the requirements before the requisition left the superintendent's hands.

(5) If the tools requisitioned are to replace others, can the old tools be repaired economically and returned to service? This feature of tool upkeep will require expert knowledge of costs and ability to discriminate between tools that are beyond repair and those that may be salvaged.

(6) If the required tools are to be used only occasionally, can the tool be borrowed from some other department within the works?

The card shown in Fig. 1 is useful for keeping track of tools purchased and the form to be used by the tool director in requisitioning through the purchasing department is shown in Fig. 2. So that there shall be no duplication of orders, no one should be authorized to requisition tools except the tool director. Foremen of departments should be required to send all requests for tools to the tool director as he would perhaps be able to furnish the required tools from stock or would at any time be able to offer suggestions that would avoid the necessity of ordering them.

Upon receipt, purchased tools should be subjected

CHECK DEPARTMENT REQUISITION. Date____________191_

Material on this order should be delivered by____________191_

Quantity	Name of Article	Description	Sold by	Value
			Total	

Approved____________ ____________
Superintendent Tool Director.

FIG. 2—TOOL REQUISITION FORM

to a careful examination for defects in material, and, if necessary, be measured for accuracy of sizes. If hardened tools have been ordered to a stated degree of hardness they should be given a hardness test. The manufacturers of products requiring a high degree of interchangeability of parts often specify that taps be furnished with limits on variations from the stated pitch diameter. Milling cutters must be checked in many cases for sizes and shape.

The matter of tool inspection is one which must be left to the intelligence of the director of the department and can very easily be carried to extremes, but it is time profitably spent and the writer has found from experience that the manufacturers of small tools are more than willing to rectify an error and are pleased to have the trouble brought to their attention. This brings to mind a case where a manufacturer furnished a large hob costing about $140 for cutting gear teeth. Upon inspection this hob was found to be cracked almost its entire length due to improper heat treatment.

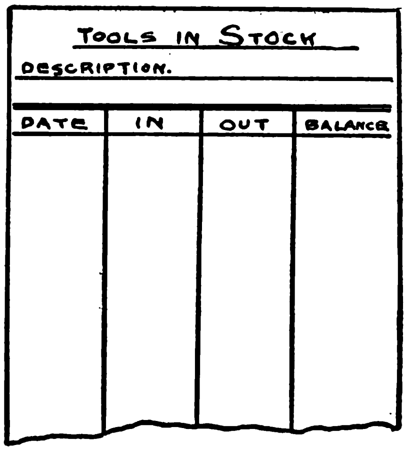


FIG. 3—PERPETUAL INVENTORY CARD

The manufacturers were notified of the defect and agreed to replace the hob should it break down. It proved necessary for them to fulfill their promise very shortly afterwards. This instance shows the importance of inspection, for had the tool been used before the defect was noticed it would not have been so easy to make a complaint. The director should be very sure that his complaint is justified before taking any action. Failure to prove his statement upon investigation by the manufacturer would result in nullifying any future complaint that he might make and would mark him as unreliable.

After the inspection of new small tools, they should be locked up either in a special room provided for that purpose or in cupboards. None but the director and one other responsible check room employee should have access to these stores. A card record, conveniently located, should be kept of all material stored and as the stock is replenished or removed, an accounting should be made directly on the record thus keeping a perpetual inventory, see Fig. 3. Only such tools as are necessary for the shop should be in circulation and no tools should be withdrawn from the stock room until the old tools they are intended to replace are beyond repair.

Micrometers may be kept in a case having a glass door and should be so arranged as to hang in plain sight. A red background of the same outline as the micrometer will indicate any tool that is in service, the tool covering the outline when hanging in the case. Hooks should also be provided in the case for checks and the case locked up after working hours. It is sometimes preferable to have special boxes made for micrometers, each box containing an adjusting wrench and standard reference disk, the whole outfit being checked to the workman as a unit.

In some shops it is customary to obtain a written order from the shop foreman to get micrometers from the check room but this should really be unnecessary except that perhaps it will prevent workmen using such tools on work that can be done with ordinary calipers and so release the micrometer for other more important work. Verniers and other fine measuring tools, such as gage blocks that are used only for standard reference, may also be stored in the same way and the director should see that they are returned to their respective places at the close of the working day.

A rack containing a large number of bins, preferably of steel, should be erected for storing drills, reamers, mandrels, and kindred tools. A separate bin should be provided for each size of tool. Racks should be designed that will allow increase of the size of any bin to suit the quantity of tools to be stored and so economize on space. If the racks are of wood, the expansion feature may be provided for by having $\frac{1}{16}$-in. saw cuts at half-inch intervals directly opposite on the top and bottom of the shelf and using number twelve gage sheet iron for the sides of the bin.

Machine screw taps and number drills may best be taken care of by using a cabinet containing shallow drawers with partitions for each size of tool. Another good plan is to use small hardwood blocks drilled to receive the tap, tap drill and body size drill and check the outfit to the workman as a unit. The blocks can be incased in a collar made of standard iron pipe slightly tapered in the bore to permit of the block being driven in and so avoid splitting of the wood. The smaller sizes of pipe taps can be handled in the same way but the larger sizes will necessarily have to be handled separately on account of their bulk. Tap wrenches will occupy the least space if a small hole is drilled close to the end of the handle so that they may hang on nails driven into a board.

Toolholders should be separated as to size and kind in individual bins. Forged tools should be kept in an open cabinet with shallow shelves and separated according to shape, size and whether carbon or high-speed

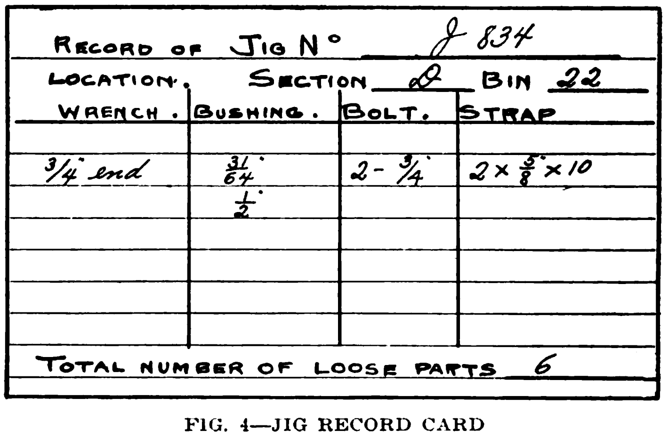


FIG. 4—JIG RECORD CARD

steel. A symbol letter should be stamped on the tool indicating the brand of steel of which it is made and figures should be used to indicate its shape. A copy of these symbols should be furnished for the use of the tool dresser so that he will give the proper heat treatment. Die stocks may be economically disposed of in the same manner as tap wrenches. For the sizes in common use around the shop it is better to furnish full stocked dies, leaving the dies set permanently. This will save the workman's time in setting the die

and offset the small additional expense of the die stock.

Pipe and U. S. standard hand dies can be stored in shallow drawers partitioned off and labeled for each die, the same segments of the die always being kept together. Chasers for bolt and pipe threaders should be stored in separate shallow bins and kept in sets as received from the manufacturer and this is especially important where it is the custom to use chasers that have been recut. While these chasers are generally supposed to be interchangeable it will be found that it is preferable to keep the sets intact as only by so doing can the best results be obtained and spoiled work be reduced to a minimum.

Spring dies and hollow mills, when not kept on their permanent arbors, may be stored in trays in which wooden pegs, smaller in diameter than the holes in the cutters, are fastened vertically to the bottom board by means of screws. The cutters may then be arranged in groups according to type and size. Milling cutters can be kept in an orderly manner by hinging wooden leaves around a post or a stand built for that purpose, hanging the cutters on nails and labeling each space according to the cutter to be placed thereon. Extra large and heavy cutters will of necessity have to be kept on shelves properly partitioned for them.

Gear cutters may be stored in the same way as milling cutters and a convenient plan of the board is to arrange by pitch vertically and by the number of the cutter horizontally. A good supply of standard sizes of bolts of various lengths should always be on hand and kept in such condition that the nuts may be run down the full length of the thread with the fingers. A bolt on which it is necessary to turn the nut with a wrench is an abomination. Straps of different sizes and kinds with bolt holes drilled every two inches of length should also be on hand in liberal quantities.

Storage of Blueprints

Provision is made in many factory systems for furnishing a drawing of the part to be made with the shop order but as a general rule it is necessary for the workman to get his blueprints from the check room. In order to protect them they should be mounted on stiff cardboard or on sheet iron and then be shellacked to allow for the removal of grease. Blueprints so mounted may be stored by filing vertically in deep drawers in the same way as office records are filed. The prints may be separated by index sheets also of iron with the blueprint number thereon and provided with a receptacle or clip for receiving the workman's check.

An accurate record of all prints in the shop should be kept by the tool director so that if a change on the print is necessary, it will be possible to know exactly how many prints at a given time are in service and to see that all are returned to the drafting room when changes are made, thus avoiding the possibility of an old print being used in the shop and a quantity of work spoiled through the change not being noted thereon.

Welding torches and all appliances, wrenches, etc., should be stored in a box provided with lock and key and charged to the workman as a unit, a card record of the contents which should comprise a standard equipment being kept in the check room. Tool cabinets may be designed of square or hexagon shape mounted on a ball bearing base to permit of being revolved. Such an arrangement is very convenient and economical in the amount of floor space occupied.

Jigs and fixtures are usually of such a bulky nature as to cause considerable trouble in providing for their proper storage and accessibility. If a large number of such tools are in frequent use it is well to have a separate room devoted exclusively to their storage. Substantial bins should be erected, each section being small enough, about six feet in length, to allow for removal without interference with the arrangement in general should the occasion arise and each section should be partitioned to suit each individual jig in so far as is practical. A card record should be kept of all jigs in storage indicating the section and the number of the bin and the quantity and size of straps, nuts, bolts and loose parts such as removable bushings, special wrenches, etc. See Fig. 4.

Systems for Checking the Tools

Sections may be distinguished by letters and the bins by numbers. For instance, the tool attendant knowing the number of a jig, would find on his card record that it is stored in section D, Bin 22, and would note the quantity of loose parts that must be used with the jig. Each section of bins may be easily lettered by nailing a piece of sheet iron to the top and painting the letters thereon very prominently. The bins may also be numbered either directly on the shelves or by a square piece of sheet iron on which the number is painted. If the bins are painted black and the numbers in chrome yellow a good contrast is obtained, making the figures easily discernible at a distance.

A large machine-tool factory in the middle west employed a number of messenger boys whose duties consisted of taking workmen's checks and getting tools for them from the check room. These messengers were stationed at certain points in the shop and were at the beck and call of the workmen. The system was not an unqualified success principally because the boys revolted from such menial duties in a very short time. As no boy with ambition would accept such a position, it took considerable energy to keep up a force of trained messengers and after a fair trial the plan was dropped.

Another concern manufacturing farm tractors has a shop telephone system operating directly between groups of machines and the check room. The telephones are numerous and conveniently placed. The floor inspector upon observing that a machine is nearing the end of a job will notify the time-keeper and routing clerk to that effect. The routing clerk then notifies the check room of the job next in order for that machine. The check room, having a card record of all tools used on the job, will deliver the tools required to the machine and at the same time bring back the tools not needed from the previous job.

If the tools require sharpening, the workman telephones the check department to that effect and either another tool is sent out or the dull tool is called for, sharpened and returned. This method is a good one and the messenger boy is not necessarily kept on the same job every day as it can be arranged to alternate the duties so that a boy may spend one day delivering tools and the next day be kept busy on work within the check room such as sorting, sharpening and repairing tools.

If it is thought preferable to give written rather than verbal orders to the check department the routing clerk could easily send this order by means of a pneumatic tube if compressed air is available in the shop. Where there are several check rooms in one factory, a telephone system is a great convenience to the tool

director enabling him to reach distant points easily and to keep on the trail of his men far better than if it were necessary for him to walk around the plant.

A common fault with most check room windows is the lack of space provided for the workmen to receive their tools, usually only one or two men being accommodated at the same time. To avoid this condition, the windows should be at least six feet in length and of a generous height with ample shelf space.

A Plan for Unit Storing

A highly commendable plan, where sufficient tools are in stock to permit of such an arrangement, is to assemble all tools used on a particular piece of work in a box, not allowing them to be used on any other work than the piece specified. The box would be given a number or symbol and be identified by it. A printed card should be fastened on the box preferably in a label holder to permit of the card being changed and stating exactly the tools that should be therein. Upon the tools being returned to the check room, they should be ground and put in first-class condition ready for the next order of these particular pieces. This method wherever possible, will prove to be very efficient, and a big time saver, inasmuch as the tools are always ready and exactly suitable for the next job.

Engineering Sales Methods

By C. J. Morrison

Engineering sales methods instead of ordinary salesmanship will save the day for the machine-tool builders if applied in an energetic, constructive manner. The field at present for installations in new or enlarged shops is not large, but the field for replacing old, worn out and obsolete machines is very large and is the one in which engineering methods are particularly needed and where these methods will bring in results satisfactory to both the customer and the builder.

It is not sufficient simply to tell a machine-tool user that he should replace his old machines with new ones, but he must be shown in a concrete way what profit will be made on the investment. A study should be made of the manufacturing methods, the present costs of operations determined, and a report submitted showing the economies to be effected by purchasing new equipment and the returns which this will give on the investment. It is too much to expect the average shop manager to do this for himself and, besides, he may not know the times that are required for operations on the new machines, or he may not realize the hand work that may be eliminated by the use of machines which will produce more accurate work than the ones he is using.

The Policy of One User of Machine Tools

There is one very large user of machine tools who has a fixed policy that any machine replacing an old one must pay for itself in five years. This company has very accurate costs, is always willing to be shown, and places all the necessary information at the disposal of any reputable concern which wishes to submit a proposition. However, it is a pure waste of time simply to state that the proposed machine will meet the requirements and pay for itself in five years. A detailed report with blueprints showing the set-ups and times must be submitted, but if this report proves the case, a sale is almost certain.

Probably the biggest field for replacements is in the railroad shops, most of which are loaded up with machines that outlived their usefulness many years ago. Also the railroad shops have a large number of home-made machines, many of which are quite efficient, but others of which are expensive jokes. These conditions are due largely to the fact that the shops are side issues with the railroads and are simply tolerated as an unavoidable expense. Appropriations for machines are hard to get and are often so curtailed that a compromise has to be made and machines purchased that are not all they should be, but which are cheap. This condition also accounts for many of the home-made machines because they can be manufactured without a special appropriation.

An educational campaign conducted by engineer salesmen will develop this field. These men should work with the superintendents of motive power and prepare reports for the officials who control the appropriations showing exactly what economies the proposed machines will effect and particularly the reductions that will be made in the time lost by locomotives and cars undergoing repairs. These men thoroughly understand charts and figures and if the facts are properly presented to them, sales can be made. Once the purchase of specific machines is authorized, the purchasing agent will buy them and nothing else.

There has been too much effort made to sell the railroads merely lathes, planers, boring mills, and machines of a similar class, and too little to show specifically what certain machines would accomplish. The railroad officials have been prone to authorize the purchase of a certain number of each kind of machine and the purchasing agents naturally bought the cheapest they could get. Under those conditions the men in charge of the shops have become discouraged and have taken what they could get and not what they wanted. The machine-tool builders can change these conditions and, as a result, sell many machines.

Railroad Shops Have Little Use for "Repetitive" Machines

A mistake that has frequently been made in the past should be carefully guarded against, that is, of trying to sell the railroads machines that are particularly efficient only for repetitive manufacturing. The railroads have little use for such machines and, outside of a few in the main shops of the larger roads, they are more of a hindrance than a help.

The textile plants and the companies manufacturing textile machinery afford another good field for engineering salesmanship, but these concerns will have to be shown in very much the same way that the railroads must be shown. In this field considerable engineering ability may have to be used because the textile industry is filled with the traditions of how grandfather did things and probably it has taken less advantage of modern metals and practices than has any other industry. In order to make sales, the engineer may have to go so far as to redesign some of the textile machines, but the field is so full of opportunity that the effort can scarcely fail to obtain the desired reward.

Other fields can be developed in the same way, but the two mentioned are the most promising at the present time. Of course the work involved in carrying out the suggestions made is a species of "free service" but the results will certainly be far more profitable than allowing shops to run on part time and of offering to sell machines at cost for the one and only purpose of keeping the plant running.

Maintenance of Small Portable Power Tools

First of Several Articles — Periodical Inspection of Prime Importance —Schemes to Insure Thorough and Regular Lubrication

BY R. P. WALSH

TOOLS WHICH are used for fabricating or measuring to exact dimensions and commonly known as "Precision Tools," have been so well covered in trade periodicals that their construction and uses are generally known. There is, however, a large class of important tools common to steel fabrication trades that has not received the attention it deserves.

Pneumatic drilling machines, riveting and chipping hammers, holder-on machines, rivet sets, countersinks, twist drills and bridge reamers are examples of tools included in this class. It is proposed in what follows to deal with some representative tools of the "Non-precision" class so that users of such tools may, it is hoped, be given information which will result in their more economical use. The necessity of keeping accurate and detailed records of tools, so that such records may be consulted when considering the purchase of new equipment, is generally recognized, but in a large percentage of cases ignored. The pneumatic drilling machine is a case in point. This is a portable power tool of complicated mechanical construction which is in a class by itself in the amount of abuse it is called upon to withstand in service.

TYPE / CAPACITY / M'FGR. / PLACED IN SERVICE — PURCHASED / COST / M'FGR. NO. / SHOP NO.

RETURNED FOR REPAIRS	REPAIRS COMPLETED	NATURE OF REPAIRS	PARTS REPLACED	COST OF MATERIAL	COST OF LABOR	COST TOTAL

FIG. 1—GENERAL INFORMATION RECORD CARD

Operated by compressed air, its pistons and valves are subjected to the abrasive action of water of condensation containing particles of iron oxide or other matter from the walls of the compressed air piping. This is particularly true where the machine is used outdoors in cold weather.

The speed of a pneumatic drilling machine is never constant, fluctuating according to the hardness of the material being drilled and to the irregularity of feed, the latter depending upon the skill of the operator. In addition, and with few exceptions, the machine is moved for every hole. When the operator is working on a piece work basis, hundreds of holes are drilled or reamed during the day, necessitating rapid shifting of the machine, and increasing the liability of damage. Great care must also be exercised by the operator in manipulating the machine when the drill is breaking through the work.

A proper record on this type of machine, see Fig. 1, should contain the following information: Type, capacity, name of manufacturer, date of purchase, cost, manufacturer's serial number, shop identification number, date when placed in service, a complete record of all dates when the machine was returned to shop for repairs, when machine was again placed in service together with details as to the nature of the repairs, parts replaced, their cost and the labor involved. If, in addition to the foregoing, the rule be followed of turning in all machines at the end of the working period for lubrication, a close approximation can be made of the actual number of hours a machine has been in operation and thus its suitability may be determined.

It is of prime importance to have all portable power tools turned in at regular periods for examination as it frequently happens that such an examination discloses defects which might do serious damage to a tool if not discovered in time. Because of the extent to which pneumatic drilling machines are employed, their high cost and their liability to damage due to the severe conditions under which they are used, it is considered desirable to describe how such tools are handled in a large ship yard with satisfactory results.

The purchase of the machine is based solely on merit as determined by its performance under tests governed by actual service conditions. Weight is also given to all pertinent data such as previous experience with the type being tested, economy of operation, cost of spare parts, ease of repair, ease of operation, etc. The price of the machine is, of course, important but is not considered more so than performance.

MACHINE — YARD NO.

MUSTER NUMBER	TOOL CHECK NO	ISSUED	RETURNED	JOB

FIG. 2—TOOL ISSUE RECORD CARD

After the purchase of the tool, it is drawn from stock on a standard form of requisition and delivered to the main toolroom where it is card indexed, given a shop identification number, lubricated, operated for a few moments without load and then assigned to a place on the issuing rack. A second index card, Fig. 2, is used when the machine is issued to record the name of the mechanic requiring it, as well as the date of

issuance and job he is on. The date of return to the toolroom is also noted. This procedure is repeated each time the machine is issued.

Upon each return of the tool to the toolroom it is tested to determine its condition and, if found in proper working order, it is then lubricated and placed upon the issuing rack. Machines found defective are tagged and set aside for repair. Lack of periodic and proper lubrication is without doubt responsible in a greater degree than any other factor for shortening the life of a pneumatic tool. In the ship yard referred to, it is required that each drilling machine be turned in to a greasing rack upon the completion of the work period for oiling and greasing. This rack is of convenient form and boxed in so that it can be locked; moreover it is so located as to make it convenient for the men to turn in or obtain their machines. Wherever it is necessary two or more of these racks are used.

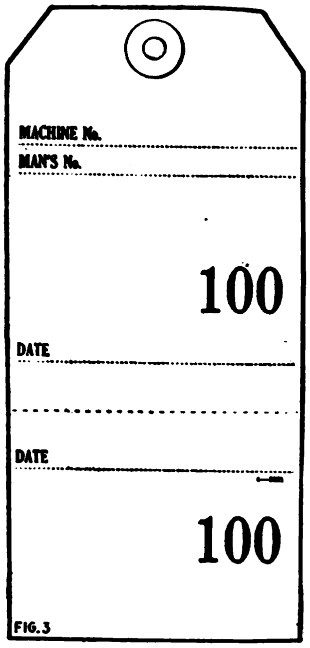
When the operator reports for work at the morning muster, the supervisor at the muster check board hands him a linen tag with stub attached. Both tag and stub are numbered and bear the date issued. Before turning in his machine upon completion of the day's work, it is required that the mechanic tie the large section of the tag to the feed screw spindle, retaining the stub. Upon presentation of the stub the following day at the morning or noon muster, the machine is returned except when the stub is presented two days later than the date indicated by stamp on the stub.

Checking up on Lubrication

In order to enable the "greaser" to spot at once any machine that has previously been oiled and greased and to avoid duplication of work, and also pick out machines that have remained on the rack for three successive days, the machine tags as shown in Fig. 3 are used in three colors, red, white and blue. A red tag is issued one day, a white tag the next day and the blue tag on the third day. The "greaser" working on a blue tag day knows that any machine having a red or white tag attached has already been oiled and greased and also knows that any machine with a blue tag of a date other than that on which he is greasing has been on the rack at least three days. After a machine has remained on the rack for three days it is returned to the toolroom in order that the number of idle machines may be reduced to the minimum.

No driller is permitted to have more than two machines (they must be of different capacities) on tool checks at any one time. If some of the machines prove more satisfactory than others it is frequently the practice among the operators to hide away the live or dead handle of a machine preferred to the others thus to insure that no one else can use it. As this practice, if unchecked, means the loss of small parts and the existence of a class of "pet" machines, penalties should be inflicted in such cases where the parts were found missing and steps be taken to bring all machines to the same high rating. The machines appearing on the list of those oiled and greased during the night should be checked against the list of machines shown to be in service and operators having tool checks on machines not appearing on the list of machines greased are called upon for an explanation, which, if unsatisfactory, results in disciplinary action being taken. Usually the delinquent is warned on the first offense and on the second reduced in rating.

While the system of using the three colored linen tags has proved quite satisfactory for the yard in question it is considered that the duplicate brass check system is more generally satisfactory. In the latter system, the operator, when turning in his machine at the end of the work period, receives a numbered brass check from the man in charge of the greasing rack and the duplicate, suspended from a split brass ring, is forced on to a spoke of the feed screw handle. By this arrangement no time is lost in turning in the machine, and it is not necessary for each individual mechanic to carry a linen tag in an overalls pocket during the day and tie such a tag on the machine when turning it in to the greasing rack. Often the linen tag when handled by greasy hands becomes soiled, making it impossible to decipher the tag number and



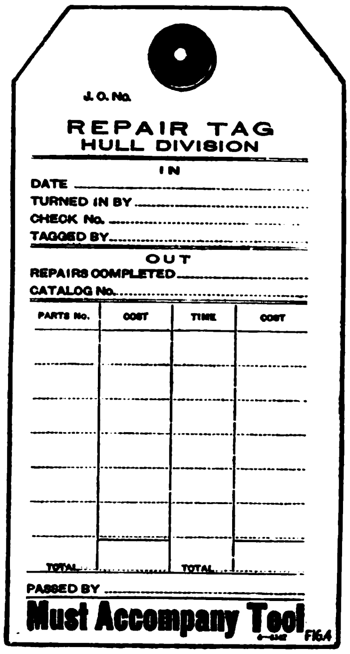


FIG. 3—COLORED TAG USED TO AVOID DUPLICATION OF GREASING. FIG. 4—REPAIR TAG

causing confusion in identifying the machine it covers. Such tags are also easily destroyed and it is necessary to carry a considerable supply in stock, whereas the brass checks may be used over and over again indefinitely. Under the duplicate brass check system, all machines, not claimed at the morning muster, are returned to the main toolroom and no machines are held on the racks. This means that a smaller number of machines may be carried in stock.

Inspection and Maintenance Suggestions

As previously stated, the periodic lubrication of pneumatic drilling machines is of the first importance, if they are to be kept in good working order. At the present time, there are on the market oils and greases specifically made for pneumatic tools and these may be purchased from the manufacturers of the tools. It is not well to experiment with unknown lubricants.

As a means of prolonging the life of his machine, a driller should up-end the tool for a short interval, for example, during the time it is laid down to change a reamer or twist drill, or for any other reason. This permits the oils and greases to run back over the crankshaft, pistons, etc. When the machine is in use the lubricants tend to gravitate away from the upper work-

ing parts. In the smaller, faster running machines this precaution cannot be ignored and if followed will do much to cut down the cost of repairs.

At the periodic examination a careful scrutiny should be made of the condition of the internal wall and the slot of the spindle taking the Morse taper shank of the tools driven by the machine. For this purpose a small electric light bulb, such as is used on a pocket flashlight may be employed in combination with a dry cell. The light bulb connected to wire leads from the battery, of sufficient length to fully explore the length of the spindle, is lowered through the spindle hole and illuminates the interior surfaces so that their condition may be observed.

All abrasions of this interior surface should be removed either by reaming or scraping and all spindles whose slots are found to be worn too large should be replaced. If this practice is followed the number of drills, reamers, countersinks and other tools rendered unserviceable because of broken or twisted tangs will be very materially reduced. A single pneumatic drilling machine with a defective spindle can ruin more tools, without being suspected, than any other destructive agent known.

Morse taper shanks are ground to size so that they may intimately fit the sleeve, socket or spindle used as a medium in the drive and consequently any inequality of the internal surface of the sleeve, socket or spindle which does not permit the intimate contact serves to throw the torque of the drive on the tang of the Morse taper shanked tool, with the inevitable result of injuring the tang. Greasy or dirty tool shanks are also a prolific source of tang destruction. When a tool is turned in for repairs, the linen tag shown in Fig. 4 is attached to it and remains with it until the tool is repaired, tested and returned to the tool room, ready for re-issue.

Misapplied Machine Tools—Discussion

By S. R. Holmes

The writer wishes to add his "Amen" to the article with the above caption on page 736, but thinks the most glaring and expensive example was overlooked by Mr. Nevin.

Can a man who respects fine machine tools see a precision lathe used with a grinding attachment, without gnashing his teeth? Such jobs usually require accuracy and therefore the best tool-room lathe available is selected. How long can the shears, cross-slide and leadscrew be expected to retain their accuracy when a little abrasive dust is occasionally added to the necessary lubricating oil?

If a lathe is not built to stand milling operations, how much less will it stand the after effects of grinding? The writer has seen examples of the finest lathes practically ruined, so far as accurate tool-room work is concerned, in two years' time, by workmen who were otherwise careful but used their lathes occasionally for grinding. Similar lathes, after twenty years of service, were practically as good as new. The grinding must be done dry, and it is impossible to protect the working parts referred to. Bench lathes are of course used for grinding operations, but the compound rest and threading attachment are first removed and the plain surface of the bed is easily cleaned.

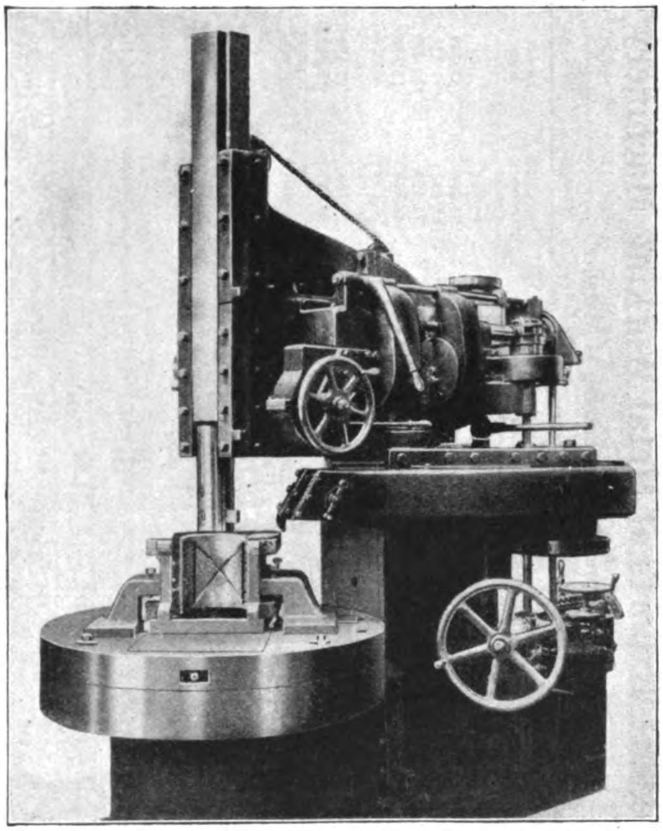
Modern grinding machines form a part of the equipment of any shop likely to have a precision lathe, but they are usually not equipped for grinding threads, and a lathe with some portable grinding attachment is "misapplied" to the job. The threads so produced, even if good, are expensive when the injury to the lathe is considered.

A Correction

Through an unfortunate mistake the article "Repair Work in a Tennessee Railroad Shop," which appeared in our last issue, was published before it had been approved and released by the Southern Railway System.

In releasing the article for publication, the Southern Railway System requested the following changes as here set forth:

The first illustration showing the repair on a slipper type crosshead, should have been omitted together with the description of how the repair was made. Repairing fractures by the method given is contrary to the approved practice of the Southern Railway System and is resorted to only in extreme emergencies that are, of course, of infrequent occurrence.



BORING AND FACING MILL FOR LOCOMOTIVE DRIVING BOXES

In explanation of Figs. 2 and 3 showing repairs on an air-pump head and a piston it was stated that brass is used. The material used to build up the worn surfaces is Tobin bronze which is an alloy giving much longer wearing life than brass.

Since the article was written, the practice of boring driving boxes has been changed so that the method shown in Fig. 4 is now obsolete. The vertical boring and facing mill, shown in the accompanying illustration, built by William Sellers & Co., Inc., especially for boring and facing driving boxes, has been installed and the work is now done in a much more efficient manner than was formerly the case.

TABLE VII

Sweden—Exports of Metal Working Machinery

"Maskiner for Bearbetning af Metaller"

Country	1909 Kg.	1909 Kroner	1910 Kg.	1910 Kroner	1911 Kg.	1911 Kroner	1912 Kg.	1912 Kroner	1913 Kg.	1913 Kroner	Kg.
Norway	33,310	23,764	39,063	35,543	81,495	75,545	....	....	....	....	18,069
Finland	55,387	47,144	31,869	25,153	90,896	93,276	57,749	52,765	....	....	95,668
Russia in Europe	110,617	302,057	73,780	150,046	95,997	187,137	191,321	231,361	92,215	137,395	368,499
Denmark	43,439	29,520	66,601	45,469	118,625	72,527	149,342	96,456	191,290	140,706	127,240
Germany	32,683	43,378	39,835	90,237	114,144	144,070	16,644	37,394	20,460	21,900	84,372
Netherlands	421	2,135	2,473	5,380	....	....	....	....	....	....	....
Belgium	3,870	5,290	13,854	13,467	18,894	30,395	....	....	....	....	....
Britain	12,464	13,709	19,416	20,296	21,653	23,158	13,573	14,330	19,848	26,280	17,037
France	2,679	4,745	9,841	18,135	53,828	58,559	32,812	35,430	59,518	69,587	8,300
Spain	1,396	2,073	1,250	1,250	....	....	....	....	....	....	....
Portugal	735	700	1,635	2,060	....	....	....	....	....	....	....
Italy	287	1,080	249	1,400	....	....	....	....	....	....	....
Switzerland	....	....	5,894	6,750	....	....	....	....	....	....	....
Austria	864	970	2,610	7,603	13,124	19,960	....	....	....	....	....
Hungary	501	1,292	826	690	....	....	....	....	....	....	....
Roumania	....	....	....	....	....	....	....	....	....	....	....
Bulgaria	22	40	....	....	....	....	....	....	....	....	....
Iceland	....	....	....	....	....	....	....	....	....	....	....
Egypt	....	....	71	44	....	....	....	....	....	....	....
British South Africa	933	1,750	636	520	....	....	....	....	....	....	....
China	....	....	....	....	....	....	....	....	....	....	....
Japan	545	295	3,272	2,306	....	....	....	....	....	....	....
Other Asia	240	150	....	....	....	....	....	....	....	....	....
Australia	3,510	3,213	13,584	13,856	17,436	17,771	....	....	10,710	11,150	11,228
British North America	920	850	....	....	....	....	....	....	....	....	....
United States of America	993	2,000	712	4,100	....	....	....	....	....	....	....
Brazil	1,380	555	....	....	....	....	....	....	....	....	....
Argentina	3,260	2,292	2,041	1,970	....	....	....	....	....	....	....
Other Countries	....	....	....	....	22,221	31,087	227,088	294,104	202,598	262,836	185,453
Total	310,456	489,002	329,512	448,275	648,313	753,485	688,529	771,840	598,339	669,854	915,866

Par value of Krona — 26.80c.
Note.—Only monthly reports are available for 1920 and 1921—the figures do not show the countries of destination, and metal working machinery is included with woodworking and other industrial machinery.

TABLE VIII

Sweden—Imports of Metal Working Machinery

"Maskiner for Bearbetning af Metaller"

Country	1909 Kilograms	1909 Kroner	1910 Kilograms	1910 Kroner	1911 Kilograms	1911 Kroner	1912 Kilograms	1912 Kroner	1913 Kilograms	1913 Kroner	1914 Kilograms	1914 Kroner
Norway	40,488	20,573	44,756	46,514	62,059	66,589	....	....	....	....	....	....
Finland	3,210	2,552	1,953	1,232	....	....	....	....	....	....	....	....
Russia	3	43	....	....	....	....	....	....	....	....	....	....
Denmark	9,325	15,087	59,614	72,750	51,620	49,806	....	....	38,052	33,684	20,323	29,219
Germany	1,065,990	827,195	1,445,973	1,060,176	1,532,656	1,207,591	1,015,038	1,200,456	1,590,190	1,741,685	985,919	1,124,310
Netherlands	8,693	5,560	16,139	4,890	....	....	....	....	9,821	11,534	....	....
Great Britain	235,109	249,108	324,344	345,335	336,557	341,213	178,163	210,199	213,848	334,356	214,261	304,442
France	9,513	9,549	2,701	3,387	....	....	....	....	....	....	....	....
Switzerland	1,767	1,874	113	694	5,787	16,688	....	....	....	....	....	....
Austria	110	679	51	556	....	....	....	....	....	....	....	....
Belgium	....	....	2,001	5,727	48,482	12,114	....	....	....	....	....	....
United States of America	152,054	241,698	249,165	356,055	223,095	389,119	257,998	448,934	612,211	1,054,671	310,738	571,745
Other Countries	....	....	....	....	21,435	11,354	148,920	208,491	99,867	142,514	95,519	128,763
Total	1,526,262	1,373,918	2,146,810	1,897,316	2,281,691	2,094,474	1,610,119	2,068,080	2,563,989	3,318,444	1,626,760	2,158,479

TABLE VII

Sweden—Exports of Metal Working Machinery—*Continued*

"Maskiner for Bearbetning af Metaller"

Country	1914 Kroner	1915 Kg.	1915 Kroner	1916 Kg.	1916 Kroner	1917 Kg.	1917 Kroner	1918 Kg.	1918 Kroner	1919 Kg.	1919 Kroner
Norway	10,071	58,915	65,619	505,524	747,978	425,480	1,066,200	610,698	1,926,194	392,486	1,087,723
Finland	169,693	508,214	936,566	513,421	1,115,237	220,325	707,815	31,742	91,024	52,770	240,598
Russia in Europe	739,626	1,992,561	4,539,405	2,259,053	5,914,629	1,323,747	4,193,567	12,477	40,949		
Denmark	89,889	386,581	516,898	375,990	533,566	142,638	226,860	267,174	763,871	238,445	435,262
Germany	75,150	433,023	870,148	382,757	1,385,768	1,589,615	6,010,000	5,117	32,525		
Netherlands				125,170	311,285	111, 08	319,869	505,456	1,739,126	78,922	297,989
Belgium										32,709	145,036
Britain	18,747	45,489	58,004	19,299	47,314	47,867	182,398	139,112	897,044	86,380	248,937
France	17,760	8,790	10,340	99,976	274,029	56,837	150,916			144,860	455,202
Spain										28,476	97,288
Portugal											
Italy				6,100	13,000					30,491	154,940
Switzerland								8,900	25,950		
Austria		228,922	508,505	86,083	248,830	219,763	760,050	19,084	69,635		
Hungary		35,798	93,150								
Roumania											
Bulgaria											
Iceland				1,947	2,[illegible]64						
Egypt											
British South Africa											
China											
Japan						5,416	29,500				
Other Asia											
Australia	11,095			5,739	10,305						
British North America											
United States of America				27,925	104,493			42,915	233,657		
Brazil											
Argentina											
Other Countries	219,702	210,828	261,009	136,699	231,303	259,982	553,497	146,605	472,309	292,373	890,833
Total	1,351,733	3,909,121	7,859,644	4,545,683	10,939,801	4,402,678	14,200,272	1,789,280	6,292,284	1,377,912	4,053,808

Par value of Krona 26.80

Note.—Only monthly reports are available for 1920 and 1921—the figures do not show the countries of destination, and metal working machinery is included with woodworking and other industrial machinery.

TABLE VIII

Sweden—Imports of Metal Working Machinery—*Continued*

"Maskiner for Bearbetning af Metaller"

Country	1915 Kilograms	1915 Kroner	1916 Kilograms	1916 Kroner	1917 Kilograms	1917 Kroner	1918 Kilograms	1918 Kroner	1919 Kilograms	1919 Kroner
Norway	7,277	15,877	34,445	143,646	104,873	370,412	45,613	214,148	35,623	78,504
Finland										
Russia										
Denmark	4,935	9,631	124,690	284,806	208,811	593,783	229,562	729,394	63,055	204,082
Germany	165,624	198,396	454,131	496,741	200,763	162,992	207,636	273,245	931,699	1,260,328
Netherlands										
Great Britain	78,071	100,409	6,925	15,027			2,108	4,397	12,008	17,503
France										
Switzerland			5,081	13,896			594	762		
Austria										
Belgium										
United States of America	391,365	725,112	523,298	1,078,372	274,028	802,586	236,307	929,079	920,046	3,121,620
Other Countries	100,868	138,853	72,983	106,130	107,936	255,794	71,027	207,099	116,568	286,210
Total	748,131	1,188,278	1,221,553	2,138,618	896,411	2,185,567	792,847	2,303,224	2,078,999	4,968,247

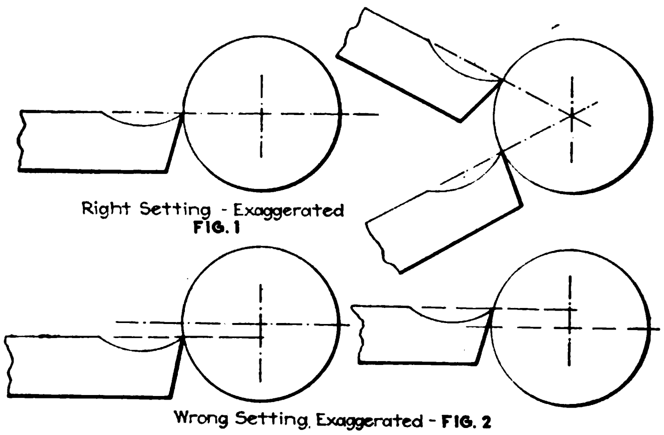
Par value of Krona is 26.80c.

Know Why You Do Things

By S. R. Hunter

Some of the articles published in *American Machinist* under the above title, during the early part of last year have brought out, in a very entertaining and instructive manner, some points which were under discussion when I first entered the shop as an apprentice. Doubtless the same subjects were argued over long before that time, but, as a charter member of the "Irememberwaybackwhen" Club, I would like to recall attention to those articles which contained discussions as to whether or not a lathe tool (I refer to the point of the tool) should be set above, upon, or below the center line of the work being turned.

It is evident that a great difference of opinion will be expressed, because of the application of the question to different jobs and conditions of work. I believe every practical lathe operator and machinist will admit that it is much easier to face a disk true and without chatter marks if the tool point is set slightly lower than the center of the disk to be faced, but on cylindrical work there will, doubtless, be room for argument.



FIGS. 1 AND 2—RIGHT AND WRONG SETTINGS OF LATHE TOOLS

Generally speaking, I am of the opinion that the best results can be obtained if the cutting edge of the tool is set on a radial line from the center of the work being turned (See Fig. 1) and I believe John Brent had this in mind in his article which appeared on page 565 in the March 31, 1921 issue of the *American Machinist.*

This setting may be obtained usually by tipping the tool either up or down at the point as the case may be. With the possible exception of a job of large diameter, I do not believe any benefit will be derived from having the point of the tool set below or above the center line (See Fig. 2) and not set at any angle corresponding to a radial line drawn from the center of the work. The radial line with this setting should be parallel to the top of the cutting tool.

I take exception to Mr. Brent's statement that "the machine for grinding tools is of no use to a real machinist," as I believe every machinist, real or otherwise, who has been privileged to use turning tools ground on a machine would never have any desire to go back to the old method. The saving in time, which results in having all turning tools ground on a machine, is a very big factor from the viewpoint of reduced cost of production, to say nothing of the inconvenience to which the machinist is put when he is obliged to shut down his machine, make a trip to the grinder, and perhaps stand in line, waiting his turn, in order to grind his own turning tools to meet his individual fancy.

Anyone who has worked in a shop where it is only necessary to turn in the dull tool at the crib or go to the board where wooden models of all standard tools are kept and to pick out the number of the one required in order to get a freshly ground one will, I believe, not suffer from homesickness for the old method. There are, however, some cases when special work is done in limited quantities and where it may still be necessary, or at least advisable, to have some tools ground in the shop where they are used. Generally speaking, however, the number of such jobs can be reduced to a very small minority by careful planning.

I do not agree with Mr. Brent in his definition of a machinist. Of course there are machinists, real machinists, and all around machinists and, as it is apparent, judging from the information we have available covering machinist apprenticeship training courses, that the aim of practically all manufacturers, who have courses of training in effect, is to produce all around machinists. My definition will apply only to this particular species.

The all around machinist, to my way of thinking, should be a man capable of handling any productive operation which may arise in a machine shop. This should include necessary experience which will enable him, in any case of necessity, to make a simple sketch, as well as to make the simple patterns or forgings required and to do any and all machine, bench, hand, floor and assembly work involved to put the mechanism into usable shape.

To do this the machinist should be able to figure gears. line up and set up any machine tool with its counter and line shaft and pulleys, lace and apply the required belting, as well as to forge, temper and grind the necessary tools. Any man who cannot function as outlined above to my mind should not be classified as an all around machinist. He had better be catalogued as a one-sided machinist or specialist. The millwright, bench hand, fitter, erector, machine operator and assembler come under this classification, while the title "all around machinist" should apply only to one who is an all around man or one who can "handle any job in the shop."

It is admitted that these men are mighty scarce and, as a general rule, they never have to look for a job. If, in addition to the above attainments, they possess a willingness to assume responsibility and some of that indefinable ingredient known as executive ability they usually become foremen at a comparatively early age and, perhaps later, superintendents and works managers.

The Foreman's Biggest Job

By Robert Grimshaw

The foreman's biggest job is not the understanding and handling of the machinery, the materials or the workers. Nor does it lie in understanding the methods by which these are utilized to the best advantage of all concerned—including the community. But his biggest job is the understanding and handling of his own personal equipment for his job. It is knowing his possibilities and his limitations and how to utilize the first to the fullest and how to counteract the latter. This he may learn by self-analysis and study, and sometimes by the help of "friend wife."

What's Wrong with the Railroad Shops?—III

Small Tool Situation—Lack of Co-operaton Between Mechanical and Purchasing Departments—Inadequacy of Tool-Sharpening Equipment

BROADLY SPEAKING, the tooling in the railroad shop is neglected. There are cutters and lathe tools and drills just like the ones you would find in any machine shop but they do not seem to have been selected by men who understood the requirements of the railroad shop. There seems to be little doubt that the difficulty arises from the relations existing between mechanical department and purchasing department.

The function of any mechanical department is to get out the best possible work at the least possible cost. To accomplish this end the men at the head of it are naturally anxious to get the tools and equipment best suited to the purpose, the cost of such equipment being less important than its capacity. The purchasing department on the other hand is expected to meet the requirements of the mechanical department in the way of tools and supplies at the least possible cost. Where the two departments work hand in hand, each sympathetic with the purpose of the other and willing to compromise for the good of the whole company, excellent results are possible. When the two departments are constantly at loggerheads the result is more than apt to be quite the reverse.

WHAT WAS said in the previous article about machine tools and equipment applies with equal force to small tools. Our observations led us to believe that little betterment of the small-tool situation in the railroad repair shops is to be expected until some means are found to secure co-operation between the mechanical and purchasing departments. By the very nature of things their functions are diametrically opposed and the way to get them together is through the personal intervention of the man to whom they report. It is asking a good deal of a busy official to expect him to take the time to bring about such co-operation, but it is asking entirely too much to expect his subordinates to do it if he appears not to have the interest in the problem which could cause him to devote some time to it. Where he leads they will be glad to follow.

In the majority of railroad shops the co-operation of the purchasing department and the mechanical department leaves much to be desired and is undoubtedly responsible for many of the faults we are pointing out in these articles. We shall have more to say on this particular point, which is a management function, in a later article.

With very few exceptions the railroad shop employs no tool engineer. As a rule the work which would naturally be done by such a man is entrusted to the toolroom foreman. It is not fair to expect that a man whose experience has been entirely along the line of making things should also be a capable designer. We saw some instances where the toolroom foreman had made meritorious attempts to improve existing tools and make special tools for certain kinds of work, but in most cases these attempts showed very clearly that ambition and ingenuity were handicapped by the lack of detailed knowledge and engineering ability.

The average toolroom foreman has neither the time nor the opportunity to watch the various jobs in the shop to an extent that would enable him to form ideas as to the best method of performing a given operation or the best construction of the tool used. It is just as wrong to expect the toolroom foreman to design tools as it is to expect the master mechanic to design locomotives. Toolroom foremen have designed tools and master mechanics have designed locomotives. Perhaps that is why we have such a complete lack of standardization in both.

A visit to the largest repair shop of one important railroad system showed conditions that would be difficult to duplicate in anything but a railroad shop. At the carwheel boring machine 400 pairs of boring tools were neatly hung on pegs on two blackboards. At a slotter 460 tools were found ranging in composition from chilled cast iron to the latest high-speed steel, and in shape through all the known forms and far into the realm of the unknown. These two lots of tools had been collected gradually by the men then working on the machines and their predecessors and were conclusive proof that the practice in this particular shop had been developed entirely by the men themselves without any instructions or control from the outside.

If it is too much to expect of a toolroom foreman that he should be able to design tools, isn't it rather worse to expect the machine operator to develop his own tools and methods? Experience in production shops indicates that the development of tools and methods cannot be left in the hands of even the brightest and most energetic machine operator. Such a man is not in a position where he has the time or the facilities to do the necessary experimenting to decide on the best methods or tools, although if this same man were put at such experimental work he might perhaps prove to be exactly fitted for the task.

Stranger than the fact that many necessary tools are not made or supplied is the fact that some of the best talent in the shop is employed in making simple standard tools which can be bought in any hardware store at less than half the cost. It seems incredible that a modern shop superintendent would permit an expert blacksmith to spend his time forging cold chisels and heads for sledge hammers at a time when locomotive repairs were being delayed through lack of them, yet that was exactly what was being done in a number of shops. The blacksmith was not engaged in making a tool that was needed in a hurry, an emergency job, but was making a deliberate attempt to manufacture, for he was supplied with a good set of dies for making several sizes of chisels.

It may be that the cost record shows that the chisels can be made somewhat more cheaply at home. If so it

is almost sure that the cost record is at fault, but whether these cold chisels were actually cheaper than those one can buy in the hardware store is a point of minor importance. The main thing is that a skilled man engaged in a railroad shop should not be employed in making articles which can be bought in the open market.

If the purchasing department does not honor requisitions so that the shop is habitually short of the necessary tools the shop is practically justified in helping itself in making what it needs, but this is no excuse for the company as a whole. Another excuse may be the idea that here is a skillful man for whom there is not sufficient work at present but whom one wants to retain in the organization. This situation may partly justify the shop management but certainly not the company.

In the same shop we were told that there was a rule against making parts for stock. Had such a rule not been issued the shop management could have put this man to work making articles which at one time or another would be required for the repair of locomotives or cars.

Inadequate Tool Sharpening Equipment

In most of the shops the equipment for sharpening tools was inadequate. It must be said here in fairness to the railroad shops that the same remark might be made about most other machine shops, but it is no excuse for any man's neglect that other men are equally neglectful.

Cutter sharpening unquestionably was below par. Not only was there a lack of proper equipment but what equipment there was was generally not used to the best advantage. There seemed to be an absence of knowledge as to what was required in a tool and the means to obtain it. The fact that cutters intended for the same or similar work were ground with different clearances and with and without rake, all in the same shop, shows the truth of our contention. A further investigation showed that, even if this knowledge had not been lacking, there would not have been the proper equipment to get good and uniform results. Tool grinders, it is true, were found in most of the shops visited, but there was an utter lack of uniformity of angles though the tools were to be used for the same kind of work and in the same shop.

One story we ran across has nothing to do with tool sharpening but it does bear out the statement that knowledge of what is required of a tool is lacking. This happened in one of the best-equipped and best-managed railroad shops in the country during the early days of the war. The shop had been using high-speed drills wherever possible and the men in charge were rather pleased with the results they were getting. The war, however, soon drove the price of high-speed drills to a height beyond the reach of the railroad exchequer and it was reluctantly decided to go back to carbon drills.

The change was made and some time later a check was made on the speeds and feeds of the drilling machines throughout the shop. Considerable consternation arose when it was discovered that not a single change in speeds or feeds had been made and that apparently the carbon drills were standing up in an entirely satisfactory way. Just how many thousands of dollars had been wasted by driving the high-speed drills to a fraction of their capacity will never be known but the loss is typical of many similar ones brought out through like ignorance or lack of interest. Assigning a new Pacific type locomotive to hauling two day coaches and a combination regularly on a three-mile branch line would be a money-saving proposition compared to it.

Another evidence of the insufficient or inefficient sharpening equipment was the condition of the reamers, boring tools and similar precision tools. They were neither round nor sharp nor ground to any definite size. This condition we are glad to say was by no means universal. In some of the shops equipment of this nature was kept in excellent condition. While we are on the subject of reamers we might mention one odd fact about bridge reamers. Although it is well established that a ground bridge reamer lasts many times as long as one that is used in the rough, most shops seem to buy them unground.

Jigs and fixtures are conspicuous by their absence and those that are in use are pretty primitive. The lack of such essential parts of the equipment of manufacturing plants may be explained, at least partly, by the fact that railroad shops do not make parts in quantity. Jigs and fixtures, however, are not used merely for the purpose of reducing the cost of things but also to make them better and particularly to make them interchangeable. Though the cost of the piece itself might not have been lessened, interchangeability reduces the cost of its installing in the finished product.

We shall have more to say about the lack of standardization but it should be mentioned here that many things are done which could be done better if there were more uniformity of parts. Connecting rod brasses, for example, are laboriously shaped instead of being quickly milled because, so it is said, there are too many sizes to warrant the use of such costly tools as milling cutters. There is no question that many sizes are in use but that so many sizes are necessary is very doubtful.

There seems to be a general lack of appreciation of the necessity of studying operations and applying the best method available. There are a few operations which have been specialized and for which special machines or tools have been built, wheel and axle lathes for example, but on the whole little attention seems to be paid to the proper method of machining, the idea being that anything goes so long as the piece is ready when needed.

Few Jigs and Fixtures Used

An extreme example came to our notice in one of the shops, a shop by the way where the equipment was much above the average. The job was the boring of a cylindrical piece of steel which had been turned up. The hole was lengthwise with the piece which was about 5 in. in diameter and 10 in. long. The piece was clamped in an upright position against an angle plate fastened to the bed of a radial drill and a 2-in. drill did the roughing out. No jig was used although the hole was supposed to be central with the piece. A good boring bar was used for finishing but most of its accuracy was dissipated through the uncertain and wobbly connection between it and the spindle of the machine. It is difficult to imagine a worse method.

From what has gone before it may be guessed, what we found to be a fact, that instructions to the men were at most scanty, and generally missing altogether. Operations were performed according to traditional methods. Only in scattered cases had an operation been standardized and records made of it. Perhaps records existed in such cases but if so there was not sufficient contact

between the engineering department and the shop to put these records to work.

In one shop where most of the equipment was modern a large planer was out of action. The feed blocks had to be removed for repairs. After spending a good deal of time on false starts the man who had worked on it found that a large part of the driving mechanism, pulleys, pulley shaft, pulley shaft outboard bearing, some gears and other shafts had to be removed before he could remove the feed box. He had spent several days in fruitless efforts to handle it some other way and had just discovered the necessity of removing all the parts mentioned.

We asked him, "Didn't you have a blueprint of the machine or a foundation plan?"

The answer was, "No."

"Isn't there such a blueprint in the shop?"

Answer, "I don't know."

"Did you ask your foreman?"

"No."

"Didn't he tell you something about it?"

"No, he didn't."

Now it may very well be that such a blueprint existed in the engineering department. If so it would have given the necessary information and a lot of useless work would have been saved. Here was an utter lack of instruction and it seems likely also that the foreman was ignorant that such a blueprint could be had. Whether the blue print existed or not is immaterial because no attempt was made to ascertain the facts and no instructions were given to the workman except to "fix up" the machine.

This situation calls to mind the ancient army story about the flag pole. An instructor asked his class of cadets how they would proceed to erect a flag pole of given dimensions in a given spot. After much thought various more or less ingenious answers were evolved. The instructor listened to all of them and then said, "You are all wrong. You would simply say, 'Sergeant, put up that flag pole.'" This plan of operation is a very simple one for the army officer or the shop foreman, but it has its drawbacks from the point of view not only of the sergeant and the workman but as an efficient performance.

There are, of course, many men in the railroad shop who are good and faithful and willing to work but who are not exactly college professors or mechanical engineers and who are at their best only when properly instructed. There are other men, not so many perhaps, who have the mental equipment and initiative to strike out for themselves along new paths but who cannot possibly turn their gifts to the best advantage unless they are given the tools and equipment necessary to turn out a good job.

Here again the close contact between the management and the men necessary to produce results seems to be lacking. It is not that the management is standing aloof from the men but that the idea seems to prevail that the men should know what needs to be done and that they actually do know so that instructions would be superfluous and might possibly hurt the feelings of the man. It is needless to say that the feelings of a good man are never hurt when he is instructed in the proper way.

Sash Weights and Machine Tools

By Charles W. Lee

The *American Machinist* has recently, much to my gratification, published a mighty fine little booklet, "Machine Tools and the Machines They Build," which exposes a false idea that I have long been fighting, that of considering the value of machine tools in terms of weight.

I hope this booklet will accomplish more than I have; this "how much a pound" idea is so firmly established that my converts total only two among those who have been looking at the matter from the buyer's viewpoint.

One of the converts was the superintendent of a large plant making small low-priced steam engines who said that he had to figure his stuff by the pound and that there was no reason why machine tools shouldn't be so figured. Explanations that the more skilled labor put into a certain weight of material the harder and more undesirable it was to sell it by the pound were of no avail. He said:

"I keep my sizes just as close as any machine tool maker in the world. I admit it is not necessary to the working of the engines, but I more than make it up in economy of assembling" (a point which might well be considered in some places I know of). "Come with me; I'll show you something."

And I did and he did. What he showed was a first class measuring machine. "There," he said, "we can easily measure to the ten thousandth part of an inch on that machine." And he mentioned the cost, which ran into thousands of dollars.

"And how much does it weigh?" I softly asked. And that converted *him*!

The other convert was the president of a somewhat similar concern who did not make as much of a point of what his product cost per pound, as he did of the price per pound of a machine that was being offered him and alleged to be every bit as good as the one I was offering. At the end of a (perfect) day of periodical battles, he said:

"We will have a directors' meeting at 9 a.m. tomorrow. Come around."

At the meeting the battle raged until the president said, "What will you do if we absolutely refuse to pay your price?"

"Take the next train out of town; what time does it leave?"

"Eleven o'clock."

Looking at my watch, shaking it, holding it to my ear, and trying, evidently with success, to achieve an expression of chagrin and dismay, I said:

"What time is it anyhow?"

The president pulled out a very nice looking watch. "Nine-thirty."

"Are you *sure* your watch is right? Is it a *good* watch?"

The president began to get a little peeved: "Bet your life it's a good watch. I paid two hundred and fifty for it!"

"How much a pound was that?"

And so the directors gave the president the "ha, ha" and me the order. Yes, they really did, although I hate to mention it on account of confessing the harmless chicanery in the matter of my watch, which the astute reader knows was running merrily along all the time.

I've had two converts but I want more.

Learning the Trade Forty Years Ago

N. S. DAVENPORT

(The last of four articles)

The means for spacing the carriage forward at the end of each cycle was peculiar. A smooth round shaft extended the whole length of the machine under the carriage, and this shaft was given an intermittent endwise movement by means of a suitable cam. The amplitude of the movement was adjustable to suit different pitches of the beam.

A fixed boss on the underside of the carriage, through which the shaft passed, was provided with a grip that could be closed upon the shaft or released to allow the shaft to slide freely through it, the grip being operated by a separate cam. When the log was carrying the work across the cutter the carriage was tightly gripped to the shaft, which was at this moment stationary; but when the oscillating movement had ceased the grip was released and the shaft moved back to its limit. The carriage grip would then close and the shaft would move forward, carrying with it the entire carriage with the work upon it. Other and later machines for the same purpose were provided with screw and ratchet mechanisms for indexing, but this old machine did excellent work.

"Sealing" the Scale Beams

All the beams were, however, subjected to a later operation known as "sealing," performed after the scales were assembled. To do this the sealer would first place the poise in the zero notch and adjust the scale to bring the beam into balance. He would then place a standard weight upon the platform of the scale and move the poise one notch forward. If the beam did not then balance he would file the notch forward or backward as the position of the beam indicated until it did. This operation would then be continued by adding weights to the platform and correcting each notch as required to the end of the beam.

Setting the pivots in these large scale beams was quite an exacting job. The pivots were of square-sectioned steel, necessitating a square hole and a nice fit in the beam. A hole, equal in diameter to the measurement across the flats of the pivots would first be drilled in the beam and then filed nearly to the required size and shape, after which a square broach was forced through it.

The pivots were hand-forged and finished to size by filing. They were also slightly tapered to insure a tight fit in the beam. A pivot would be driven part way through the hole and then tested for "squareness" and position and if any error was disclosed by this test the pivot would be forced out and the error corrected by filing. This was really fine work and was done by some of the most skilled men in the shop.

Grinding the Cutters

One of my jobs in the toolroom was to grind the cutters used for cutting the notches in the beams. These cutters were perhaps 5 in. in diameter by about ½ in. thick at the center, tapering somewhat toward the periphery where the teeth were shaped to conform to the contour of the notches. The arbor holes were parallel and were not chambered in the middle as is now the common practice; nor were the holes ground after hardening.

In the cutter grinding machine the cutters were placed on a fixed bar and slid past the wheel by the operator's fingers. If the center hole was not round neither would the periphery be round; and, as I had received little instruction as to the manner of grinding and had not been impressed with the need for care and accuracy, I suspected that some of the cutters I ground were no better than they should have been. Also, with the grade of wheels we used in those days many of the teeth were softened by the heat of grinding, though I always took care to grind away the tell-tale blue that would have disclosed this condition.

The tool room was equipped with a good Pratt & Whitney lathe, but I was not allowed to use it much, although on occasions I would escape the vigilant eye of the boss and try my hand at it. It was with the help of this lathe that I built my first automatic machine.

My First Automatic Machine

One of the jobs that was delegated to the "kid" in the toolroom was the making of the little "fish-hooks" of iron wire with which the molders in the foundry suspended the pivots in the molds when castings were being made that required the pivots to be cast in. It was a tedious and monotonous job to bend hundreds of the little hooks, all alike, with no tools other than the bare fingers and a pair of round-nose pliers, so I devised a way to do it by machinery.

I took an 8-lb. scale weight, smoothed off one side flat for the base of my machine and fastened to it suitably shaped pieces of steel to form the hook. The movable part of the former was attached to a short lever that was fulcrumed on the base, so that by placing the short pieces of wire and pulling the lever I would get a completed hook in one movement.

This was good as far as it went and far better than the hand and plier method; but I would always rather turn a crank than pull a lever so later I added another part, made from a sewing machine balance wheel with a pitman attached to the lever, so that I could turn the crank continuously with one hand while feeding in the short wires with the other.

Improvements Suggested

One of the men, Powers by name, who had previously worked in the toolroom and had special privileges there, became interested in my device and suggested further improvements. Together we worked out and built a crank and ratchet device by means of which the wire would be fed in from a coil and cut off automatically. When this had been accomplished, a round belt from the line shaft to the balance wheel added the final touch and I was an inventor, with my first automatic machine in actual operation.

I have designed and built many and complicated automatic machines since that day, but never one that gave me greater pride than I experienced when I first saw this crude little device performing so quickly and easily the work that had been so monotonous when done by hand. I suspect that a streak of laziness in my makeup has been responsible for my tendency toward automatic machinery, for I would far rather lean my elbows on a drawing board and plan out levers, gear trains, and mechanical movements than to work—even now.

And after all, has not the world advanced more because of this desire to save labor than from any other single cause? Chopping down trees may be good exercise for ex-Kaisers but a sawmill is of greater use to the world at large.

Commercial Standards

As Adopted by The Tap and Die Institute

(12 TABLES)

TABLE 1
Dimensions of Standard Hand Taps

Diam. of Tap Inches	Length, Inches		Diam. of Shank Inches	Size of Square Inches	Diam. of Tap Inches	Length, Inches		Diam. of Shank Inches	Size of Square Inches
	Thread	Overall				Thread	Overall		
1/4	1	2 1/2	.2530	.1897	1 1/4	2 9/16	5 3/4	1.0215	.7661
17/64	1	2 1/2	.2686	.2015	1 9/32	2 9/16	5 3/4	1.0527	.7895
9/32	1	2 1/2	.2843	.2132	1 5/16	2 9/16	5 3/4	1.0840	.8130
19/64	1	2 1/2	.2999	.2249	1 3/8	3	6 1/16	1.1083	.8312
5/16	1 1/8	2 23/32	.3155	.2366	1 13/32	3	6 1/16	1.1395	.8546
21/64	1 1/8	2 23/32	.3311	.2483	1 7/16	3	6 1/16	1.1708	.8781
11/32	1 1/8	2 23/32	3468	.2601	1 1/2	3	6 3/8	1.2333	.9250
23/64	1 1/8	2 23/32	.3624	.2718	1 17/32	3	6 3/8	1.2645	.9484
3/8	1 1/4	2 15/16	.3785	.2839	1 5/8	3 3/16	6 11/16	1.3050	.9787
25/64	1 1/4	2 15/16	.3941	.2956	1 21/32	3 3/16	6 11/16	1.3362	1.0021
13/32	1 1/4	2 15/16	.4098	.3074	1 3/4	3 3/16	7	1.4300	1.0725
					1 25/32	3 3/16	7	1.4612	1.0959
3/8	1 1/4	2 15/16	.2750	2062	1 7/8	3 9/16	7 5/16	1 5195	1.1396
25/64	1 1/4	2 15/16	.2906	.2179	1 29/32	3 9/16	7 5/16	1.5507	1 1630
13/32	1 1/4	2 15/16	.3062	.2296	2	3 9/16	7 5/8	1.6445	1.2334
27/64	1 1/4	2 15/16	.3218	.2414	2 1/32	3 9/16	7 5/8	1.6757	1.2568
7/16	1 7/16	3 5/32	.3232	.2124	2 1/8	3 9/16	8	1.7694	1.3271
29/64	1 7/16	3 5/32	.3388	.2541	2 5/32	3 9/16	8	1.8007	1.3505
15/32	1 7/16	3 5/32	.3544	.2658	2 1/4	3 9/16	8 1/4	1.8911	1.4208
31/64	1 7/16	3 5/32	.3700	.2775	2 9/32	3 9/16	8 1/4	1.9257	1.4443
1/2	1 21/32	3 3/8	.3667	.2750	2 3/8	4	8 1/2	2.0194	1.5146
33/64	1 21/32	3 3/8	.3823	.2867	2 13/32	4	8 1/2	2.0507	1.5380
17/32	1 21/32	3 3/8	.3979	.2984	2 1/2	4	8 3/4	2.1000	1.5750
35/64	1 21/32	3 3/8	.4135	.3101	2 17/32	4	8 3/4	2.1313	1.5984
9/16	1 21/32	3 19/32	.4292	.3219	2 5/8	4	8 3/4	2.2250	1.6687
37/64	1 21/32	3 19/32	.4448	.3336	2 21/32	4	8 3/4	2.2563	1.6922
19/32	1 21/32	3 19/32	.4604	.3453	2 3/4	4	9 1/4	2.3500	1.7625
39/64	1 21/32	3 19/32	.4760	.3570	2 25/32	4	9 1/4	2.3813	1.7859
5/8	1 13/16	3 13/16	.4796	.3597	2 7/8	4	9 1/4	2.4750	1.8562
41/64	1 13/16	3 13/16	.4952	.3714	2 29/32	4	9 1/4	2.5063	1.8797
21/32	1 13/16	3 13/16	.5108	.3831	3	4 9/16	9 3/4	2.5429	1.9072
11/16	1 13/16	4 1/32	.5421	.4066	3 1/32	4 9/16	9 3/4	2.5742	1.9306
23/32	1 13/16	4 1/32	.5733	.4300	3 1/8	4 9/16	9 3/4	2.6679	2.0009
3/4	2	4 1/4	.5900	.4425	3 5/32	4 9/16	9 3/4	2.6992	2.0244
25/32	2	4 1/4	.6212	.4659	3 1/4	4 9/16	10	2.7929	2.0946
13/16	2	4 15/32	.6525	.4894	3 9/32	4 9/16	10	2.8242	2.1181
27/32	2	4 15/32	.6837	.5128	3 3/8	4 9/16	10	2.8827	2.1620
7/8	2 7/32	4 11/16	.6973	.5230	3 13/32	4 9/16	10	2.9140	2.1855
29/32	2 7/32	4 11/16	.7285	.5464	3 1/2	4 15/16	10 1/4	3.0077	2.2557
15/16	2 7/32	4 29/32	.7598	.5698	3 17/32	4 15/16	10 1/4	3.0390	2.2792
31/32	2 7/32	4 29/32	.7910	.5932	3 5/8	4 15/16	10 1/4	3.1327	2.3495
1	2 1/2	5 1/8	.8000	.6000	3 21/32	4 15/16	10 1/4	3.1640	2.3730
1 1/32	2 1/2	5 1/8	.8312	.6234	3 3/4	5 5/16	10 1/2	3.2167	2.4125
1 1/16	2 1/2	5 1/8	.8625	6469	3 25/32	5 5/16	10 1/2	3.2479	2.4359
1 1/8	2 9/16	5 7/16	.8965	6724	3 7/8	5 5/16	10 1/2	3.3417	2.5062
1 5/32	2 9/16	5 7/16	.9277	.6958	3 29/32	5 5/16	10 1/2	3.3729	2.5297
1 3/16	2 9/16	5 7/16	.9590	.7192	4	5 5/16	10 3/4	3.4667	2.6000

NOTE.—For Tolerances, see Table 3
For Fine Pitch Taps over 1 1/2" see Table 2

TABLE 2
Dimensions of Special Hand Taps Over 1 1/2" Diameter Having 10 or More Threads per Inch

Diameter of Tap Inches	Length, Inches		Diameter of Shank Inches	Size of Square Inches
	Thread	Overall		
1 5/8	2	5	1.3050	.9787
1 3/4	2	5	1.4300	1.0725
1 7/8	2	5	1.5195	1.1396
2	2	5	1.6445	1.2334
2 1/8	2	5 1/4	1.7695	1.3271
2 1/4	2	5 1/4	1.8911	1.4208
2 3/8	2	5 1/4	2.0194	1.5146
2 1/2	2	5 1/4	2.1000	1.5750
2 5/8	2	5 1/2	2.2250	1.6687
2 3/4	2	5 1/2	2.3500	1.7625
2 7/8	2	5 1/2	2.4750	1.8562
3	2	5 1/2	2.5429	1.9072
3 1/8	2	5 3/4	2.6679	2.0009
3 1/4	2	5 3/4	2.7929	2.0946
3 3/8	2	5 3/4	2.8827	2.1620
3 1/2	2	5 3/4	3.0077	2.2557
3 5/8	2	6	3.1327	2.3495
3 3/4	2	6	3.2167	2.4125
3 7/8	2	6	3.3417	2.5062
4	2	6	3.4667	2.6000

Diameter of Shank and size of square are same as for Standard Hand Taps. (See Table I.)

Tolerances for All Hand Taps

Length overall, 1/4" to 1 1/32" incl.	plus or minus 1/32"
Length overall, 1 1/16" to 4" incl.	plus or minus 1/16"
Length of thread	plus or minus 3/64"
Diameter of shank to 1" incl.	size to size minus .005"
Diameter of shank 1 1/32" to 2" incl.	size to size minus .007"
Diameter of shank over 2"	size to size minus .009"
Size of square, 1/2" and smaller	size to size minus .004"
Size of square, 33/64" to 1" incl.	size to size minus .006"
Size of square, 1 1/32" to 2" incl.	size to size minus .008"
Size of square, 2 1/32" to 4" incl.	size to size minus .010"

Formulae

Diameter of shank = O. D. of tap — (Std. "V" Pitch × 1.6)

Size of square = Diameter of shank × .75

SEVERAL YEARS ago The Tap and Die Institute realized that there was a definite demand among the users of taps and dies for a greater degree of uniformity in these tools. Work was commenced and as a result a number of standard tables have been prepared and adopted. A number of the more important ones are presented on this and the following pages. Many other standardized dimensions of taps and dies can be found

TABLE 3
Dimensions of Pipe Taps

Nominal Sizes Inches	Length, Inches: Thread	Length, Inches: Overall	Diam. of Shank Inches	Size of Square Inches	Dist. Small End of Briggs Std. Tap Projects through Gauge	Pitch Diam. of Straight Pipe Taps, Inches: Basic	Minimum	Maximum
1/8	3/4	2 1/8	.3125 .4375	.234 .328	.312	.3748	.3733	.3763
1/4	1 1/16	2 7/16	.4375 .5625	.328 .421	.459	.4899	.4884	.4914
3/8	1 1/16	2 9/16	.5625 .7000	.421 .531	.454	.6270	.6253	.6288
1/2	1 3/8	3 1/8	.6875 .8650	.515 .640	.579	.7784	.7767	.7802
5/8	1 3/8	3 3/16	.8125 .9270	.594 .687	....	.....	.....	.....
3/4	1 3/8	3 1/4	.9063 1.0750	.679 .812	.565	.9889	.9869	.9909
7/8	1 9/16	3 1/2	1.0937	.812	....	.....	.....	.....
1	1 3/4	3 3/4	1.1250	.843	.678	1.2386	1.2366	1.2406
1 1/4	1 3/4	4	1.3125	.984	.686	1.5834	1.5811	1.5856
1 1/2	1 3/4	4 1/4	1.5000	1.125	.699	1.8223	1.8201	1.8246
1 3/4	1 3/4	4 3/8	1.6250	1.218	....	......	......	......
2	1 3/4	4 1/2	1.8750	1.406	.667	2.2963	2.2938	2.2988
2 1/4	2 1/8	5	2.0000	1.500	....	......	......	......
2 1/2	2 9/16	5 1/2	2.2500	1.687	.925	2.7622	2.7594	2.7649
2 3/4	2 9/16	5 3/4	2.3750	1.781	....	......	......	......
3	2 5/8	6	2.6250	1.968	.925	3.3855	3.3858	3.3913
3 1/4	2 5/8	6 1/4	2.7500	2.062	....	......	......	......
3 1/2	2 11/16	6 1/2	2.8125	2.108	.938	3.8888	3.8861	3.8916
3 3/4	2 11/16	6 5/8	2.8750	2.156	....	......	......	......
4	2 3/4	6 3/4	3.0000	2.250	.950	4.3871	4.3844	4.3899

Tolerances

Length overall, 1/8" to 3/4" incl.	plus or minus 1/32"
Length overall, 7/8" to 4" incl.	plus or minus 1/16"
Length of thread	plus or minus 3/64"
Diameter of shank to 1/2" incl.	size to size minus .007"
Diameter of shank over 1/2"	size to size minus .009"
Size of square to 1/2" incl.	size to size minus .006"
Size of square over 1/2"	size to size minus .010"
Distance projecting through gauge, 1/8" to 3/4" incl.	plus or minus 1/16"
Distance projecting through gauge, 1" to 3 1/4" incl.	plus or minus 3/32"
Distance projecting through gauge, 3 1/2" and over	plus or minus 1/8"

TABLE 4
Dimensions of Taps for Nos. 2 1/2 and 3 Beaman & Smith Holders

Diameter of Tap Inches	For No. 2 1/2 Holder: Length of Thread	Length Overall	Diam. of Shank	For No. 3 Holder: Length of Thread	Length Overall	Diam. of Shank
1	2 1/2"	6 3/4"	1 1/2"	...	...	...
1 1/16	2 1/2"	6 3/4"	1 1/2"	...	...	...
1 1/8	2 1/2"	6 3/4"	1 1/2"	...	...	...
1 3/16	2 1/2"	6 3/4"	1 1/2"	...	...	...
1 1/4	2 5/8"	7"	1 1/2"	2 5/8"	7 1/4"	1 5/8"
1 5/16	2 5/8"	7"	1 1/2"	2 5/8"	7 1/4"	1 5/8"
1 3/8	2 3/4"	7 1/4"	1 1/2"	2 3/4"	7 1/2"	1 5/8"
1 7/16	2 3/4"	7 1/4"	1 1/2"	2 3/4"	7 1/2"	1 5/8"
1 1/2	2 7/8"	7 1/2"	1 1/2"	2 7/8"	7 3/4"	1 5/8"
1 5/8	3"	7 3/4"	1 1/2"	3"	8"	1 5/8"
1 3/4	3 1/8"	8"	1 1/2"	3 1/8"	8 1/4"	1 5/8"
1 7/8	3 1/4"	8 1/4"	1 1/2"	3 1/4"	8 1/2"	1 5/8"
2	3 3/8"	8 1/2"	1 1/2"	3 3/8"	8 3/4"	2"
2 1/8	...	...	...	3 1/2"	9"	2"
2 1/4	...	...	...	3 5/8"	9 1/4"	2"
2 3/8	...	...	...	3 3/4"	9 1/2"	2"
2 1/2	...	...	...	3 7/8"	9 3/4"	2"

Dimensions of Pipe Taps for Beaman & Smith Holders

Size Pipe	Fitting Holder Number	Diameter Shank Inches	Length Thread Inches	Length Overall Inches
1/8"	1	1/2	3/4	2 9/16
1/4"	1	1/2	1 1/16	2 7/8
3/8"	2	3/4	1 1/16	3 9/16
1/2"	2	3/4	1 3/8	3 7/8
3/4"	2	3/4	1 3/8	3 7/8
1"	2 1/2	1 1/2	1 3/4	5
1 1/4"	2 1/2	1 1/2	1 3/4	5
1 1/2"	2 1/2	1 1/2	1 3/4	5
2"	3	2	1 3/4	6
2 1/2"	3	2	2 9/16	6 13/16
3"	3	2	2 5/8	6 7/8

in the trade catalogs of the members of the Institute. The work of standardization is continually going on and from time to time additional tables will doubtless be made available in published form by the Institute.

The Tap and Die Institute was formed several years ago with the primary object of bringing about a greater degree of physical uniformity in taps and dies and, in general, so to standardize the dimensions of taps and

TABLE 5

Commercial Tolerances for Hand Taps, Pulley Taps and Taps for B. & S. Holder United States Standard

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Toler-ance	Min. = Basic Plus	Max. = Basic Plus	Toler-ance
¼–20	.2500	.2175	.0010	.0035	.0025	.0005	.0025	.0020
5/16–18	.3125	.2764	.0010	.0035	.0025	.0005	.0025	.0020
⅜–16	.3750	.3344	.0010	.0035	.0025	.0005	.0025	.0020
7/16–14	.4375	.3911	.0010	.0040	.0030	.0005	.0030	.0025
½–13	.5000	.4500	.0010	.0040	.0030	.0005	.0030	.0025
9/16–12	.5625	.5084	.0010	.0040	.0030	.0005	.0030	.0025
⅝–11	.6250	.5660	.0010	.0040	.0030	.0005	.0030	.0025
¾–10	.7500	.6851	.0010	.0050	.0040	.0005	.0035	.0030
⅞– 9	.8750	.8028	.0010	.0050	.0040	.0005	.0035	.0030
1 – 8	1.0000	.9188	.0010	.0050	.0040	.0005	.0035	.0030
1⅛– 7	1.1250	1.0322	.0015	.0060	.0045	.0005	.0040	.0035
1¼– 7	1.2500	1.1572	.0015	.0060	.0045	.0005	.0040	.0035
1⅜– 6	1.3750	1.2668	.0015	.0060	.0045	.0005	.0040	.0035
1½– 6	1.5000	1.3918	.0015	.0060	.0045	.0005	.0040	.0035
1⅝– 5½	1.6250	1.5069	.0015	.0070	.0055	.0010	.0050	.0040
1¾– 5	1.7500	1.6201	.0015	.0070	.0055	.0010	.0050	.0040
1⅞– 5	1.8750	1.7451	.0015	.0070	.0055	.0010	.0050	.0040
2 – 4½	2.0000	1.8557	.0015	.0070	.0055	.0010	.0050	.0040
2⅛– 4½	2.1250	1.9807	.0020	.0080	.0060	.0010	.0055	.0045
2¼– 4½	2.2500	2.1057	.0020	.0080	.0060	.0010	.0055	.0045
2⅜– 4	2.3750	2.2126	.0020	.0080	.0060	.0010	.0055	.0045
2½– 4	2.5000	2.3376	.0020	.0080	.0060	.0010	.0055	.0045
2⅝– 4	2.6250	2.4626	.0020	.0090	.0070	.0010	.0060	.0050
2¾– 4	2.7500	2.5876	.0020	.0090	.0070	.0010	.0060	.0050
2⅞– 3½	2.8750	2.6894	.0020	.0090	.0070	.0010	.0060	.0050
3 – 3½	3.0000	2.8144	.0020	.0090	.0070	.0010	.0060	.0050

LEAD TOLERANCE

A maximum lead error of plus or minus .003" in one inch of thread is permitted.

Taps with pitch coarser than S. A. E. Standard will take U. S. Standard tolerances. Those with pitch finer than S. A. E. Standard will take S. A. E. Standard tolerances.

TABLE 6

Commercial Tolerances for Hand Taps and Taps for B. & S. Holder S. A. E. Standard

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Toler-ance	Min. = Basic Plus	Max. = Basic Plus	Toler-ance
¼–28	.2500	.2268	.0010	.0035	.0025	.0005	.0020	.0015
5/16–24	.3125	.2854	.0010	.0035	.0025	.0005	.0020	.0015
⅜–24	.3750	.3479	.0010	.0035	.0025	.0005	.0020	.0015
7/16–20	.4375	.4050	.0010	.0040	.0030	.0005	.0025	.0020
½–20	.5000	.4675	.0010	.0040	.0030	.0005	.0025	.0020
9/16–18	.5625	.5264	.0010	.0040	.0030	.0005	.0025	.0020
⅝–18	.6250	.5889	.0010	.0040	.0030	.0005	.0025	.0020
11/16–16	.6875	.6469	.0010	.0050	.0040	.0005	.0030	.0025
¾–16	.7500	.7094	.0010	.0050	.0040	.0005	.0030	.0025
⅞–14	.8750	.8286	.0010	.0050	.0040	.0005	.0030	.0025
⅞–18	.8750	.8389	.0010	.0050	.0040	.0005	.0030	.0025
1 –14	1.0000	.9536	.0010	.0050	.0040	.0005	.0030	.0025
1⅛–12	1.1250	1.0709	.0015	.0060	.0045	.0005	.0035	.0030
1¼–12	1.2500	1.1959	.0015	.0060	.0045	.0005	.0035	.0030
1⅜–12	1.3750	1.3209	.0015	.0060	.0045	.0005	.0035	.0030
1½–12	1.5000	1.4459	.0015	.0060	.0045	.0005	.0035	.0030

*TAPS OVER 1½" WITH 10 OR MORE THREADS PER INCH

Size	Tap Measurements					
	O. D.			P. D.		
	Min. = Basic Plus	Max. = Basic Plus	Toler-ance	Min. = Basic Plus	Max. = Basic Plus	Toler-ance
1⅝" to 2" incl.	.0015	.0060	.0045	.0005	.0035	.0030
2⅛" to 3" incl.	.0015	.0060	.0045	.0005	.0040	.0035
3⅛" to 4" incl.	.0015	.0070	.0055	.0005	.0050	.0045

*For taps over 1½" with less than 10 threads per inch use tolerances for U. S. S. Taps.

LEAD TOLERANCE

A maximum lead error of plus or minus .003" in one inch of thread is permitted.

Taps with pitch coarser than S. A. E. Standard will take U. S. Standard tolerances. Those with pitch finer than S. A. E. Standard will take S. A. E. Standard tolerances.

dies as better to serve the interests of ultimate users, and bring these products into closer conformity to the standards adopted from time to time in many of the other branches of the iron and steel-working industry.

This work has been in constant progress under the direct supervision of a committee on standards whose work in turn is passed upon by the members of the Institute before it is adopted and cataloged as standard.

TABLE 7

Commercial Tolerances for Machine Screw Taps

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Tolerance	Min. = Basic Plus	Max. = Basic Plus	Tolerance
0–80	.060	.0519	.0010	.0025	.0015	.0005	.0015	.0010
1–56	.073	.0614	.0010	.0025	.0015	.0005	.0015	.0010
64	.073	.0629	.0010	.0025	.0015	.0005	.0015	.0010
72	.073	.0640	.0010	.0025	.0015	.0005	.0015	.0010
2–56	.086	.0744	.0010	.0025	.0015	.0005	.0015	.0010
64	.086	.0759	.0010	.0025	.0015	.0005	.0015	.0010
3–48	.099	.0855	.0010	.0025	.0015	.0005	.0015	.0010
56	.099	.0874	.0010	.0025	.0015	.0005	.0015	.0010
4–32	.112	.0917	.0010	.0030	.0020	.0005	.0020	.0015
36	.112	.0940	.0010	.0030	.0020	.0005	.0020	.0015
40	.112	.0958	.0010	.0030	.0020	.0005	.0020	.0015
48	.112	.0985	.0010	.0030	.0020	.0005	.0020	.0015
5–36	.125	.1070	.0010	.0030	.0020	.0005	.0020	.0015
40	.125	.1088	.0010	.0030	.0020	.0005	.0020	.0015
44	.125	.1102	.0010	.0030	.0020	.0005	.0020	.0015
6–32	.138	.1177	.0010	.0030	.0020	.0005	.0020	.0015
36	.138	.1200	.0010	.0030	.0020	.0005	.0020	.0015
40	.138	.1218	.0010	.0030	.0020	.0005	.0020	.0015
7–30	.151	.1294	.0010	.0030	.0020	.0005	.0020	.0015
32	.151	.1307	.0010	.0030	.0020	.0005	.0020	.0015
36	.151	.1330	.0010	.0030	.0020	.0005	.0020	.0015
8–30	.164	.1423	.0010	.0030	.0020	.0005	.0020	.0015
32	.164	.1437	.0010	.0030	.0020	.0005	.0020	.0015
36	.164	.1460	.0010	.0030	.0020	.0005	.0020	.0015
40	.164	.1478	.0010	.0030	.0020	.0005	.0020	.0015
9–24	.177	.1499	.0010	.0030	.0020	.0005	.0020	.0015
30	.177	.1553	.0010	.0030	.0020	.0005	.0020	.0015
32	.177	.1567	.0010	.0030	.0020	.0005	.0020	.0015

LEAD TOLERANCE

A maximum lead error of plus or minus .003" in one inch of thread is permitted.

TABLE 7
(CONCLUDED)

Commercial Tolerances for Machine Screw Taps

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Tolerance	Min. = Basic Plus	Max. = Basic Plus	Tolerance
10–24	.190	.1629	.0010	.0030	.0020	.0005	.0020	.0015
28	.190	.1668	.0010	.0030	.0020	.0005	.0020	.0015
30	.190	.1684	.0010	.0030	.0020	.0005	.0020	.0015
32	.190	.1697	.0010	.0030	.0020	.0005	.0020	.0015
12–24	.216	.1889	.0010	.0030	.0020	.0005	.0020	.0015
28	.216	.1928	.0010	.0030	.0020	.0005	.0020	.0015
32	.216	.1957	.0010	.0030	.0020	.0005	.0020	.0015
14–20	.242	.2095	.0010	.0035	.0025	.0005	.0025	.0020
24	.242	.2149	.0010	.0035	.0025	.0005	.0025	.0020
16–18	.268	.2319	.0010	.0035	.0025	.0005	.0025	.0020
20	.268	.2355	.0010	.0035	.0025	.0005	.0025	.0020
22	.268	.2385	.0010	.0035	.0025	.0005	.0025	.0020
18–18	.294	.2579	.0010	.0035	.0025	.0005	.0025	.0020
20	.294	.2615	.0010	.0035	.0025	.0005	.0025	.0020
20–16	.320	.2794	.0010	.0035	.0025	.0005	.0025	.0020
18	.320	.2839	.0010	.0035	.0025	.0005	.0025	.0020
20	.320	.2875	.0010	.0035	.0025	.0005	.0025	.0020
22–16	.346	.3054	.0010	.0035	.0025	.0005	.0025	.0020
18	.346	.3099	.0010	.0035	.0025	.0005	.0025	.0020
24–16	.372	.3314	.0010	.0035	.0025	.0005	.0025	.0020
18	.372	.3359	.0010	.0035	.0025	.0005	.0025	.0020
26–14	.398	.3516	.0010	.0040	.0030	.0005	.0030	.0025
16	.398	.3574	.0010	.0040	.0030	.0005	.0030	.0025
28–14	.424	.3776	.0010	.0040	.0030	.0005	.0030	.0025
16	.424	.3834	.0010	.0040	.0030	.0005	.0030	.0025
30–14	.450	.4036	.0010	.0040	.0030	.0005	.0030	.0025
16	.450	.4094	.0010	.0040	.0030	.0005	.0030	.0025

LEAD TOLERANCE

A maximum lead error of plus or minus .003" in one inch of thread is permitted.

It is interesting to know how and for what purposes an association of this kind was formed: Possibly the main objects can best be given by quoting from a general statement of purposes contained in its constitution:

"The purpose of the Institute shall be the improvement of the tap and die manufacturing business by striving toward the correction by all proper and legitimate means of unintelligences, faulty standardization

TABLE 8

Commercial Tolerances for Nut and Tapper Taps United States Standard

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Tolerance	Min. = Basic Plus	Max. = Basic Plus	Tolerance
1/4–20	.2500	.2175	.0020	.0050	.0030	.0015	.0010	.0025
5/16–18	.3125	.2764	.0020	.0050	.0030	.0015	.0040	.0025
3/8–16	3750	.3311	.0020	.0050	.0030	.0015	.0010	.0025
7/16–14	.4375	.3911	.0020	.0060	.0040	.0015	.0045	.0030
1/2–13	.5000	.4500	.0020	.0060	.0040	.0015	.0045	.0030
9/16–12	.5625	.5081	.0025	.0065	.0040	.0020	.0050	.0030
5/8–11	.6250	.5660	.0025	.0065	.0040	.0020	.0050	.0030
3/4–10	.7500	.6851	.0025	.0070	.0045	.0020	.0055	.0035
7/8– 9	.8750	.8028	.0025	.0070	.0045	.0020	.0055	.0035
1 – 8	1.0000	.9188	.0025	.0070	.0045	.0020	.0055	.0035
1 1/8– 7	1.1250	1.0322	.0030	.0080	.0050	.0025	.0065	.0040
1 1/4– 7	1.2500	1.1572	.0030	.0080	.0050	.0025	.0065	.0040
1 3/8– 6	1.3750	1.2668	.0030	.0080	.0050	.0025	.0065	.0040
1 1/2– 6	1.5000	1.3918	.0030	.0080	.0050	.0025	.0065	.0040
1 5/8– 5 1/2	1.6250	1.5069	.0030	.0090	.0060	.0025	.0070	.0045
1 3/4– 5	1.7500	1.6201	.0030	.0090	.0060	.0025	.0070	.0045
1 7/8– 5	1.8750	1.7451	.0030	.0090	.0060	.0025	.0070	.0045
2 – 4 1/2	2.0000	1.8557	.0030	.0090	.0060	.0025	.0070	.0045
2 1/8– 4 1/2	2.1250	1.9807	.0040	.0110	.0070	.0030	.0080	.0050
2 1/4– 4 1/2	2.2500	2.1057	.0040	.0110	.0070	.0030	.0080	.0050
2 3/8– 4	2.3750	2.2126	.0040	.0110	.0070	.0030	.0080	.0050
2 1/2– 4	2.5000	2.3376	.0040	.0110	.0070	.0030	.0080	.0050
2 5/8– 4	2.6250	2.4626	.0040	.0120	.0080	.0030	.0085	.0055
2 3/4– 4	2.7500	2.5876	.0040	.0120	.0080	.0030	.0085	.0055
2 7/8– 3 1/2	2.8750	2.6894	.0040	.0120	.0080	.0030	.0085	.0055
3 – 3 1/2	3.0000	2.8144	.0040	.0120	.0080	.0030	.0085	.0055

LEAD TOLERANCE

A maximum lead error of plus or minus .003" in once inch of thread is permitted.

Taps with pitch coarser than S. A. E. Standard will take U. S. Standard tolerances. Those with pitch finer than S. A. E. Standard will take S. A. E. Standard tolerances.

TABLE 9

Commercial Tolerances for Nut and Tapper Taps S. A. E. Standard

Size	Basic		Tap Measurements					
			O. D.			P. D.		
	O. D.	P. D.	Min. = Basic Plus	Max. = Basic Plus	Tolerance	Min. = Basic Plus	Max. = Basic Plus	Tolerance
1/4–28	.2500	.2268	.0020	.0050	.0030	.0010	.0030	.0020
5/16–24	.3125	.2854	.0020	.0050	.0030	.0010	.0030	.0020
3/8–24	.3750	.3479	.0020	.0050	.0030	.0010	.0030	.0020
7/16–20	.4375	.4050	.0020	.0060	.0040	.0010	.0035	.0025
1/2–20	.5000	.4675	.0020	.0060	0040	.0010	.0035	.0025
9/16–18	.5625	.5264	.0025	.0065	0040	.0015	.0040	0025
5/8–18	.6250	.5889	.0025	0065	.0040	.0015	.0040	0025
11/16–16	.6875	.6469	.0025	.0070	0045	0015	.0045	.0030
3/4–16	.7500	.7094	.0025	0070	.0045	.0015	0045	.0030
7/8–14	.8750	.8286	.0025	0070	.0045	.0015	.0045	.0030
7/8–18	.8750	.8389	.0025	0070	.0045	.0015	.0045	.0030
1 –14	1.0000	.9536	.0025	.0070	0045	.0015	.0045	.0030
1 1/8–12	1.1250	1.0709	.0030	.0080	0050	.0020	.0055	0035
1 1/4–12	1.2500	1.1959	.0030	0080	.0050	0020	0055	.0035
1 3/8–12	1.3750	1.3209	0030	0080	.0050	0020	.0055	.0035
1 1/2–12	1.5000	1 4459	0030	0080	0050	0020	0055	.0035

LEAD TOLERANCE

A maximum lead error of plus or minus .003" in one inch of thread is permitted.

Taps with pitch coarser than S. A. E. Standard will take U. S. Standard tolerances. Those with pitch finer than S. A. E. Standard will take S. A. E. Standard tolerances.

and abuses in the trade. To co-operate along the lines of metallurgical research in the securing of better steels for use in manufacturing taps and dies so that the result will be to raise the standard of quality to its highest point of efficiency, thereby making great savings to the consumer, and, further, to co-operate in the standardization of sizes, dimensions and tolerances of the product manufactured by the members of the Institute.

TABLE 10

Basic Thread Dimensions and Tap Drill Sizes

A. S. M. E. THREADS

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill To Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
0–80	.0600	.0519	.0438	3/64	.0469
1–56	.0730	.0614	.0498	54	.0550
64	.0730	.0629	.0527	53	.0595
72	.0730	.0640	.0550	53	.0595
2–56	.0860	.0744	.0628	50	.0700
64	.0860	.0759	.0657	50	.0700
3–48	.0990	.0855	.0719	47	.0785
56	.0990	.0874	.0758	45	.0820
4–32	.1120	.0917	.0714	45	.0820
36	.1120	.0940	.0759	44	.0860
40	.1120	.0958	.0795	43	.0890
48	.1120	.0985	.0849	42	.0935
5–36	.1250	.1078	.0889	40	.0980
40	.1250	.1088	.0925	38	.1015
44	.1250	.1102	.0955	37	.1040
6–32	.1380	.1177	.0974	36	.1065
36	.1380	.1200	.1019	34	.1110
40	.1380	.1218	.1055	33	.1130
7–30	.1510	.1294	.1077	31	.1200
32	.1510	.1307	.1104	31	.1200
36	.1510	.1330	.1149	1/8	.1250
8–30	.1640	.1423	.1207	30	.1285
32	.1640	.1437	.1234	29	.1360
36	.1640	.1460	.1279	29	.1360
40	.1640	.1478	.1315	28	.1405
9–24	.1770	.1499	.1229	29	.1360
30	.1770	.1553	.1337	27	.1440
32	.1770	.1567	.1364	26	.1470

TABLE 10
(CONCLUDED)

Basic Thread Dimensions and Tap Drill Sizes

A. S. M. E. THREADS

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
10–24	.1900	.1629	.1359	25	.1495
28	.1900	.1668	.1436	23	.1540
30	.1900	.1684	.1467	22	.1570
32	.1900	.1697	.1494	21	.1590
12–24	.2160	.1889	.1619	16	.1770
28	.2160	.1928	.1696	14	.1820
32	.2160	.1957	.1754	13	.1850
14–20	.2420	.2095	.1770	10	.1935
24	.2420	.2149	.1879	7	.2010
16–18	.2680	.2319	.1966	3	.2130
20	.2680	.2355	.2030	7/32	.2187
22	.2680	.2385	.2090	2	.2210
18–18	.2940	.2579	.2218	B	.2380
20	.2940	.2615	.2290	D	.2460
20–16	.3200	.2794	.2388	G	.2610
18	.3200	.2839	.2478	17/64	.2656
20	.3200	.2875	.2559	I	.2720
22–16	.3460	.3054	.2648	9/32	.2812
18	.3460	.3099	.2738	L	.2900
24–16	.3720	.3314	.2908	5/16	.3125
18	.3720	.3359	.2998	O	.3160
26–14	.3980	.3516	.3052	21/64	.3281
16	.3980	.3574	.3168	R	.3390
28–14	.4240	.3776	.3312	T	.3580
16	.4240	.3834	.3428	23/64	.3594
30–14	.4500	.4036	.3572	V	.3770
16	.4500	.4094	.3688	25/64	.3906

Additionally, it was designed that the Institute function as a central bureau or source of information with which other engineering and manufacturing organizations may consult, and obtain reliable information in co-operative efforts for the benefit of the industry as a whole.

The officers of the Institute are: President, F. G. Echols, Vice-President and General Manager, Green-

Table 11

Basic Thread Dimensions and Tap Drill Sizes

UNITED STATES THREAD

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill To Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
1/16-64	.0625	.0524	.0422	3/64	.0469
72	.0625	.0535	.0445	3/64	.0469
5/64-60	.0781	.0673	.0563	1/16	.0625
72	.0781	.0691	.0601	52	.0635
3/32-48	.0938	.0803	.0667	49	.0730
50	.0938	.0808	.0678	49	.0730
7/64-48	.1094	.0959	.0823	43	.0890
1/8-32	.1250	.1047	.0844	3/32	.0937
40	.1250	.1088	.0925	38	.1015
9/64-40	.1406	.1244	.1081	32	.1160
5/32-32	.1563	.1360	.1157	1/8	.1250
36	.1563	.1382	.1202	30	.1285
11/64-32	.1719	.1505	.1313	9/64	.1406
3/16-24	.1875	.1604	.1334	26	.1470
32	.1875	.1672	.1469	22	.1570
13/64-24	.2031	.1760	.1490	20	.1610
7/32-24	.2188	.1919	.1646	16	.1770
32	.2188	.1985	.1782	12	.1890
15/64-24	.2344	.2073	.1806	10	.1935
1/4-20	.2500	.2176	.1850	7	.2010
24	.2500	.2229	.1959	4	.2090
27	.2500	.2260	.2019	3	.2130
28	.2500	.2268	.2036	3	.2130
32	.2500	.2297	.2094	7/32	.2187
5/16-18	.3125	.2764	.2403	F	.2570
20	.3125	.2800	.2476	17/64	.2656
24	.3125	.2854	.2584	I	.2720
27	.3125	.2884	.2644	J	.2770
32	.3125	.2922	.2719	9/32	.2812

TABLE 11
(CONTINUED)

Basic Thread Dimensions and Tap Drill Sizes

UNITED STATES THREAD

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill To Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
3/8-16	.3750	.3344	.2938	5/16	.3125
20	.3750	.3425	.3100	21/64	.3281
24	.3750	.3479	.3209	Q	.3320
27	.3750	.3509	.3269	R	.3390
7/16-14	.4375	.3911	.3447	U	.3680
20	.4375	.4050	.3726	25/64	.3906
24	.4375	.4104	.3834	X	.3970
27	.4375	.4134	.3894	Y	.4040
1/2-12	.5000	.4459	.3918	27/64	.4219
13	.5000	.4501	.4001	27/64	.4219
20	.5000	.4675	.4351	29/64	.4531
24	.5000	.4729	.4459	29/64	.4531
27	.5000	.4759	.4519	15/32	.4687
9/16-12	.5625	.5084	.4542	31/64	.4844
18	.5625	.5264	.4903	33/64	.5156
27	.5625	.5384	.5144	17/32	.5312
5/8-11	.6250	.5660	.5069	17/32	.5312
12	.6250	.5709	.5168	35/64	.5469
18	.6250	.5889	.5528	37/64	.5781
27	.6250	.6009	.5769	19/32	.5937
11/16-11	.6875	.6285	.5694	19/32	.5937
16	.6875	.6469	.6063	5/8	.6250
3/4-10	.7500	.6851	.6201	21/32	.6562
12	.7500	.6959	.6418	43/64	.6719
16	.7500	.7094	.6688	11/16	.6875
27	.7500	.7259	.7019	23/32	.7187
13/16-10	.8125	.7476	.6826	23/32	.7187
7/8-9	.8750	.8029	.7307	49/64	.7656
12	.8750	.8209	.7668	51/64	.7969
14	.8750	.8286	.7822	13/16	.8125
18	.8750	.8389	.8028	53/64	.8281
27	.8750	.8509	.8269	27/32	.8437

field Tap and Die Corporation, Greenfield, Mass.; Vice-President, J. E. Winter, General Manager, Winter Brothers Co., Wrentham, Mass.; Chairman Committee on Standards, C. M. Pond, Assistant Manager, Small Tools Department, Pratt & Whitney Co., Hartford, Conn.; Secretary, Herbert S. Blake. The office of the Tap and Die Institute, headquarters of the secretary, is located at 116-120 West 32nd Street, New York City.

TABLE 11
(CONCLUDED)

Basic Thread Dimensions and Tap Drill Sizes

UNITED STATES THREAD

Nominal Size	Outside Diameter Inches	Pitch Diameter Inches	Root Diameter Inches	Commercial Tap Drill To Produce Approx. 75% Full Thread	Decimal Equivalent of Tap Drill
15/16 - 9	.9375	.8654	.7932	53/64	.8281
1 - 8	1.0000	.9188	.8376	7/8	.8750
12	1.0000	.9459	.8918	59/64	.9219
14	1.0000	.9536	.9072	15/16	.9375
27	1.0000	.9759	.9519	31/32	.9687
1 1/8 - 7	1.1250	1.0322	.9394	63/64	.9844
12	1.1250	1.0709	1.0168	1 3/64	1.0469
1 1/4 - 7	1.2500	1.1572	1.0644	1 7/64	1.1094
12	1.2500	1.1959	1.1418	1 11/64	1.1719
1 3/8 - 6	1.3750	1.2668	1.1585	1 7/32	1.2187
12	1.3750	1.3209	1.2668	1 19/64	1.2969
1 1/2 - 6	1.5000	1.3918	1.2835	1 11/32	1.3437
12	1.5000	1.4459	1.3918	1 27/64	1.4219
1 5/8 - 5 1/2	1.6250	1.5070	1.3888	1 29/64	1.4531
1 3/4 - 5	1.7500	1.6201	1.4902	1 9/16	1.5625
1 7/8 - 5	1.8750	1.7451	1.6152	1 11/16	1.6875
2 - 4 1/2	2.0000	1.8557	1.7113	1 25/32	1.7812
2 1/8 - 4 1/2	2.1250	1.9807	1.8363	1 29/32	1.9062
2 1/4 - 4 1/2	2.2500	2.1057	1.9613	2 1/32	2.0312
2 3/8 - 4	2.3750	2.2126	2.0502	2 1/8	2.1250
2 1/2 - 4	2.5000	2.3376	2.1752	2 1/4	2.2500
2 3/4 - 4	2.7500	2.5876	2.4252	2 1/2	2.5000
3 - 3 1/2	3.0000	2.8145	2.6288	2 23/32	2.7187
3 1/4 - 3 1/2	3.2500	3.0645	2.8788	2 31/32	2.9687
3 1/2 - 3 1/4	3.5000	3.3002	3.1003	3 3/16	3.1875
3 3/4 - 3	3.7500	3.5335	3.3170	3 7/16	3.4375
4 - 3	4.0000	3.7835	3.5670	3 11/16	3.6875

TABLE 12

Chamfer on Dies

All dies listed in our catalogue will be chamfered approximately as shown in the following table. When dies are specified with a chamfer varying from that shown in the table they will be considered special.

APPROXIMATE NUMBER OF THREADS CHAMFER

Type of Die	Front Face	Rear Face
Spring Screw Threading	2 1/2 to 3	....
Solid Square Bolt	2 1/2 to 3	1 to 1 1/2
Solid Square Pipe	2 1/2 to 3	0
Adjustable Round Split, Straight Thread	2 1/2 to 3	1 to 1 1/2
Adjustable Round Split, Taper Thread	2 1/2 to 3	0
Gas Fixture	2 1/2 to 3	1 to 1 1/2
Hexagon Rethreading	1	1

Tables 5, 6, 7, 8 and 9 give commercial tolerances for taps. It should be clearly and distinctly understood that the figures given by these tables represent the measurements of the taps themselves and *not* the tapped hole.

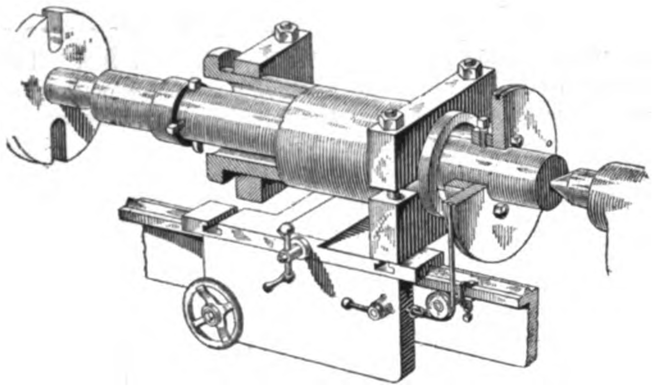
Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

A Kink in a Mexican Mine Shop

By E. W. Heinrichs
Frenillo, Mexico

In out-of-the-way places, far removed from the regular sources of supply and yet where all sorts of emergency jobs of unusual and unforeseen nature are continually presenting themselves, it is necessary to have either a very complete and comprehensive equipment or to possess a fair amount of the ingenuity that



RIG FOR OIL GROOVING LARGE BEARING SLEEVES

enables the shop man to do all sorts of jobs by improvised methods—usually the latter.

The writer is foreman of the machine shop in a Mexican silver mine and it is his duty to see that repairs to mining machinery of all kinds are made promptly and the machines kept in service. Often there are jobs to be done that are beyond the scope of the equipment and the latter must be supplemented with homemade devices and contrivances for getting out the work. One such job that came along recently was the cutting of oil grooves in some large sleeves for turbine bearings.

These sleeves were of bronze, 8 in. in diameter inside and 9½ in. outside by 24 in. long, with a substantial head at one end, as the sketch will show. To cast and machine these sleeves up to the point of cutting the oil groove was ordinary work and need not be described to the machine shop man, but the cutting of the right and left hand helical grooves was quite another matter.

The work was all done in a McCabe lathe. The sleeves were mounted on blocks on the carriage and bored in the usual way with a bar between centers. To make the oil grooves we proceeded as follows:

We fitted a 16-in. diameter blind flange to the outer end of the boring bar and fastened it with setscrews. In the periphery of the flange we then cut a groove to accommodate a ½-in. steel cable; so calculating the diameter at the bottom of the grooves as to make one-half its effective circumference equal to the length of a sleeve and thus determining the "lead" of our helix.

A small hole drilled at an angle from the groove through the side of the flange furnished a means of attaching the cable to the drum and the free end was then passed under a sheave, previously clamped to the front of the lathe bed, and carried forward to the carriage. With a suitable tool in the collar, or cutter head of the bar, we were ready to proceed with the work of cutting.

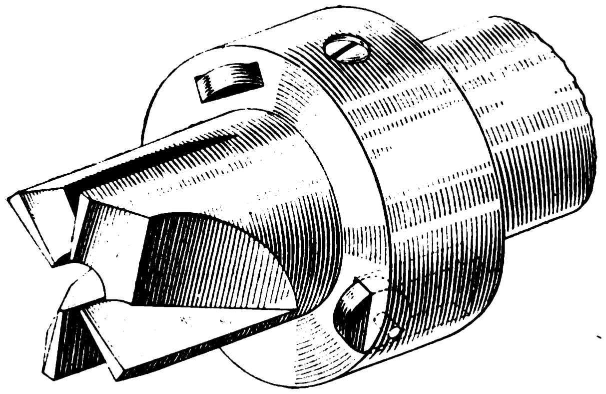
As the carriage is advanced it withdraws the cable from the drum and causes the latter to rotate one-half of a revolution in 24 in. of carriage movement. The tool was set out by hand after each successive cut. To cut the opposite helix all that was necessary was to transfer the sheave and cable to the back of the lathe, a procedure that caused the bar to rotate in the opposite direction.

The method did not require a great amount of rigging up and the job was quickly and satisfactorily done. The only objection raised was by the poor "Mex" whose duty it was to traverse the carriage by hand. He gets one peso per day of eight hours—equivalent to about 50 cents in American money—but we must not overlook the important fact that if he got more we would have to hire a new bunch of men every day.

Roller Stop for Counterbore

By C. E. Andrews

The sketch shows a roller stop that was designed for use in connection with some work having a highly finished surface that must not be marred and upon which the depth of the counterbored space must be held within very accurate limits. The ordinary form of counterbore stop would have left a blemish upon the



COUNTERBORE STOP WITH ROLLERS

surface, no matter how light the contact, and the nature of the work necessitated gaging the depth from this surface.

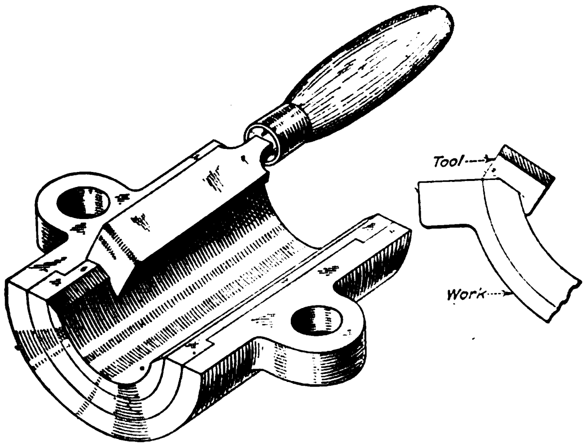
Though but one roller is shown in the sketch it is desirable to have three or more in order to balance the pressure upon the collar when the rollers contact with the gaging surface.

Chamfering the Edges of Bearing Caps

By George A. Luers

It is essential that the edges of bearing caps and bearings be beveled. A new bearing when first run will tend to flow and this space permits the metal to move out into the groove and so prevent the babbitt from burning out. Oil is distributed from the groove on the bearing surfaces, the groove serving as a reservoir.

A tool for the purpose of cutting a bevel on either the cap or the seat is illustrated in the sketch. This tool was devised to overcome some of the disadvantages encountered in making the bevel. To file the bevel is difficult because of the clogging of the file with the particles of babbitt. To chip the groove disturbs the metal in the seat, making it necessary to scrape it down afterwards.



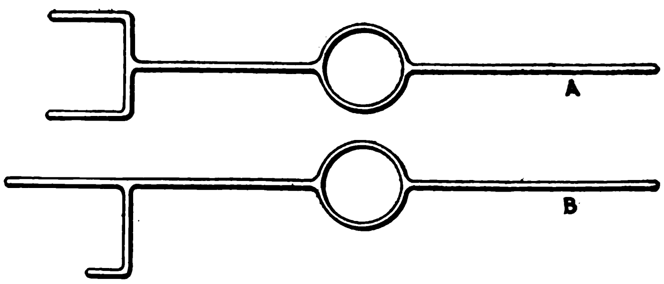
TOOL FOR BEVELING EDGES OF BABBITT BEARINGS

This bevel cutting tool has been found to do the work rapidly, cutting a clean smooth edge. The cutter may be sharpened with an oil stone on both faces, as cutting is done in both directions. The guiding surfaces are relieved by rounding the edges so that they will not cut on surfaces where cutting is not required.

A Convenient Pouring Holder

By Walter Kaufman

The average pouring holder for crucibles is as shown in sketch *A* and is a rather hard holder from which to pour accurately, as it is difficult for the men to get up to the flasks except where they are set far apart or in a circular form. In our foundry we have stands



POURING HOLDERS

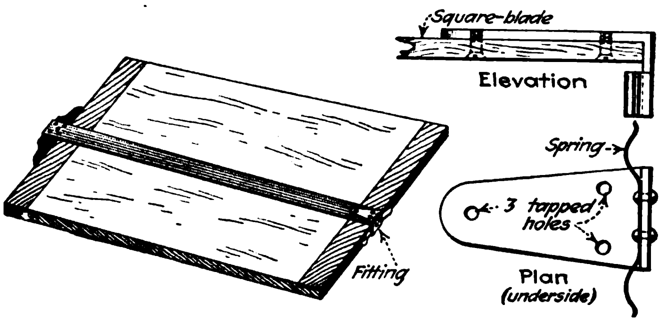
which hold flasks in a long straight line, making it very awkward to pour with the usual holder. By simply making the center rod of holder straight and making the right handle the only one used in pouring, as in sketch *B*, we make it possible for the men pouring to get up very close to the flasks and pour accurately.

A Drafting-Room Kink

By E. Lytton Brooks

The accompanying sketch shows a simple and useful little contrivance for assisting in the manipulation of large and unwieldly T-squares.

Three countersunk screws, sunk in the square blade from the underside serve to secure the fitting, which



ATTACHMENT FOR LARGE T-SQUARE

has three tapped holes $\frac{1}{8}$ in. Whitworth or 4 B.A. The spring used is $\frac{1}{2}$ in. wide by 0.020 in. thick with just enough tension to prevent the square sliding down the board from its own weight.

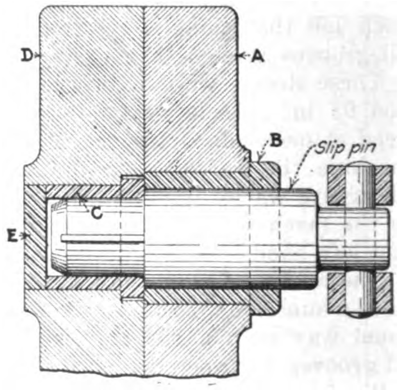
Rollers may be fitted to engage the board edge if desired, but are quite unnecessary. The square should slide up and down freely with the head kept square against the board when working properly. The fitting was made from $\frac{1}{8}$ in. aluminum sheet, but brass will answer well enough. The spring tension is determined when mounting the fitting.

An Index Lock-Pin

By C. H. Van Fossen

The illustration shows a simple method of constructing a slip-pin device for locking an indexing jig in its several positions. The same scheme may, of course, be adapted to milling fixtures and to sliding members instead of rotating ones as described, and for that reason is adaptable to many varieties of work.

A hole is first drilled and reamed in the base plate *A* to receive the hardened and ground bushing *B*, the bore of which is ground to a close fit for a standard reamer. This bushing is pressed in place and then serves as a jig through which the hole for the bushing *C* may be drilled and reamed through plate *D*. It is only necessary then to line up the two members in the required positions and ream the holes in line. A counterbore to receive the head of the bushing *C* may be added afterward.



METHOD OF FITTING A LOCK PIN

The two diameters of the slip-pin are then ground to slip fits in the respective bushings. To protect the device from dirt and chips a soft plug *E* may be added, and, in that case, the small diameter of the slip-pin should be scored to permit the escape of air when the pin enters the bushing.

Two Simple Rigs for Grinding Cutters

By I. B. Rich

For grinding the tops of the teeth of slitting saws and cutters of a similar nature the device shown in Fig. 1 has proved very satisfactory. The base *A* carries an upright with a stud *B*, considerably smaller than the hole in the cutter. The base also has a slot cut at *C* which acts as a stop for the tooth at the bottom of the cutter. In use the operator merely slips the cutter over the stud *B*, locates a tooth against the stop at *C* and pushes the cutter toward the grinding wheel *D* until it stops against the stud *B*. Assuming the teeth to be evenly spaced this gives a uniform tooth length and the grinding can be done very rapidly.

A device for use in grinding the face of the teeth of similar cutters is shown in Fig. 2. Here the stud *B* is mounted vertically in the base *A*, a top view being

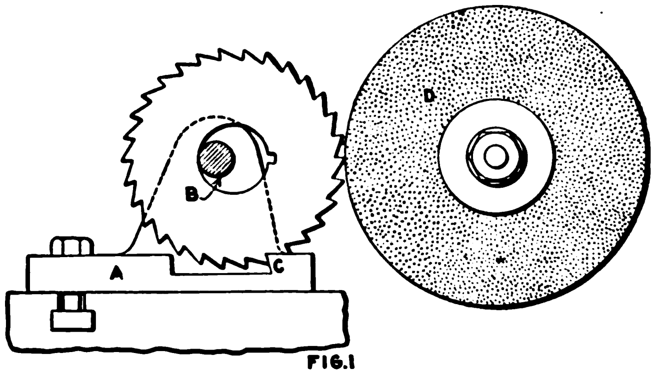


FIG.1

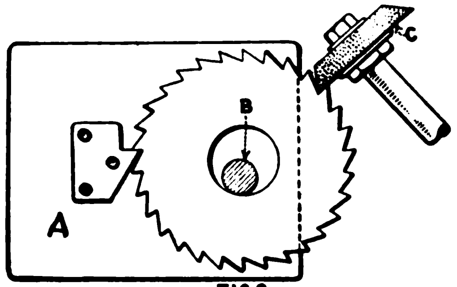


FIG.2

FIG. 1—FIXTURE FOR GRINDING CUTTER TEETH. FIG. 2—MODIFICATION FOR GRINDING FACE TEETH

shown. In order to have the cutter clear the wheel when being indexed the fixture is set on about the angle shown. The cutter is moved up against the side of the wheel *C* until it stops against the stud *B*. This device is used by the Pioneer Instrument Co., Brooklyn, N. Y.

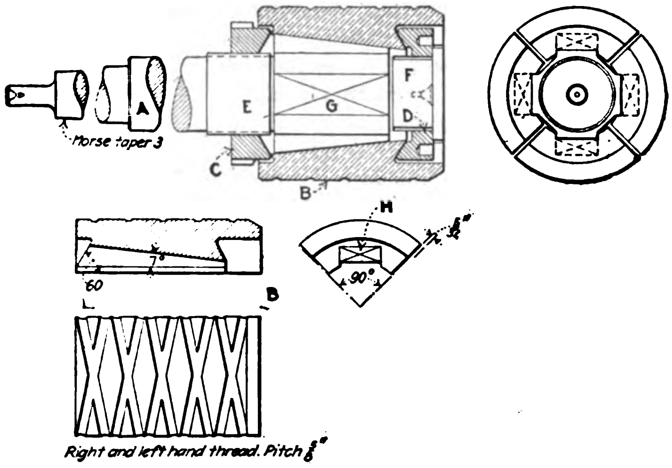
Automobile Cylinder Lap

By R. E. D. Delrue
Steyr, Austria

The accompanying illustration shows a typical design of an automobile-cylinder lap which has been used very successfully for lapping cylinders to size.

It is our practice not to grind our cylinders but to lap them to size after a series of careful boring operations. For some time we used the well-known split lap which is expanded by means of a tapered key or a wedge. Such a lap, however, has the disadvantage of expanding unevenly, the lower part increasing in size much more than the upper. This condition caused our laps to follow any unevenness in the cylinder-bore, leaving it in an imperfect condition and to avoid this trouble I constructed the lap illustrated which has the advantage of expanding evenly along its whole length, so that it needs in no case, to be turned after each resetting.

The lap consists of an arbor *A*, provided at one end with a shank to fit the lapping-machine spindle. At the



LAP FOR AUTOMOBILE CYLINDERS

other end four wedge-shaped splines are milled to receive the lapping segments *B*, which are held in position by means of the nuts *C* and *D*, engaging threads at *E* and *F*. The lapping segments are turned to shape out of a solid bar of copper after which they are sawed apart. A channel *H* is milled through their full length and is made to accurately fit the splines on arbor *A*.

After the lap is assembled, it is turned to the correct diameter and a right and left hand thread about 1/16 in. in depth cut over its surface, the thread serving to facilitate the introduction of the lubricant mixed with the lapping ingredients. To expand the lap, the nut *C* is loosened a trifle while the nut *D* is tightened. By the motion of nut *D* the lapping plates are moved towards the larger parts of the splines and expanded. The movement of the lapping plates being parallel to the axis of the arbor *A* it is possible at any time to adjust them for wear.

We have lately put in operation a somewhat different type of lap in which the lapping plates are made of steel and covered with copper to a thickness of about 1/16 in., the advantage being that after the plates have been fully expanded to take up wear, the copper plates can be removed and new ones put on. The lap is then restored to its original diameter.

Utilizing Fixtures on Different Machines—Discussion

By Stanley W. Mills

The articles under the above title by Frank C. Hudson and C. L. Henry on pages 27 and 582, Vol. 57 of the *American Machinist*, remind me that in 1908 I established a system for fixture tongues practically the same as that used by the Lucas Machine Tool Co.

The reason for an off-set tongue with respect to the slot in base of fixture is not plain to me and in fact appears to be a distinct detriment rather than an advantage, for the reason that it is entirely possible for the fixture to be mis-located with respect to the slot in the platen.

From the point of view of accurately grinding the keys or tongues which should preferably be case-hard-

ened, it appears to me to be just as simple to locate the tongue centrally with the base as in the manner shown by Mr. Hudson, although there may be some advantage in his design as applied to an overhanging fixture. I venture to disagree with the plan adopted by Mr. Henry of locating the tongues against one side only of the T-slot in the machine platen and depending upon the clamps or bolts to hold the fixture in place.

It has been my experience, and this applies not only to fixtures but also in any instance where one piece must be held definitely with relation to another, that bolts are unreliable and that a dowel or key is imperative, the function of the bolts being merely to clamp and not to position the work. Mr. Henry's plan, however, would be more or less satisfactory, if in addition to the clamps, jack screws were used against the side of the fixture to force the tongues against one side of the slot and it is possible that this device is used by him.

I believe it is recognized that in holding a casting on the faceplate of a lathe or table of a boring mill, positioning screws should always be used in conjunction with clamps, thus reproducing the effect a conventional fixture which should always be designed to rigidly hold the work from movement without dependence on clamps or bolts.

I recall that the objectionable features of different width slots in various makes of milling machines were overcome in one very well equipped shop by machining the slots in all platens to the same width. Such a plan is, of course, more or less costly and involves very careful work. Once done, however, the difficulties with keys of miscellaneous widths will be eliminated.

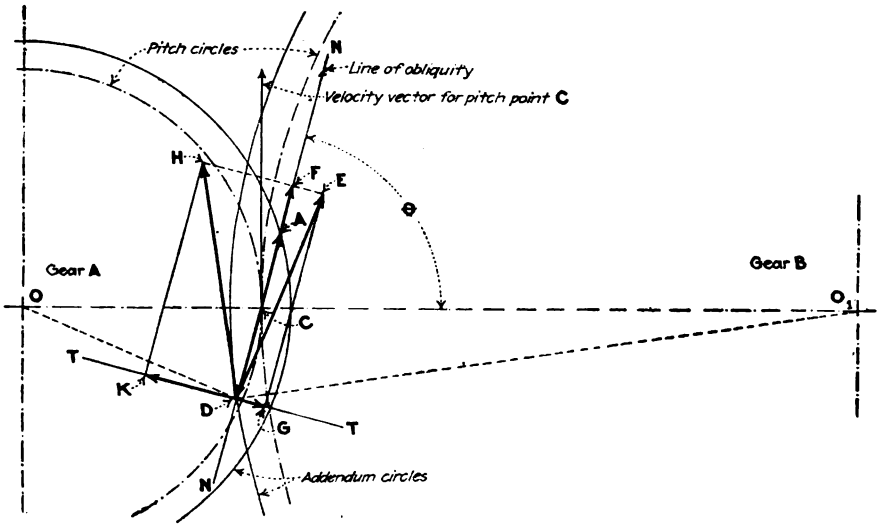
Finding the Rate of Gear Tooth Slippage

By Wm. H. Jefferis

Some time ago a large manufacturing plant experienced trouble with a pair of involute gears, designed to transmit from 50 to 75 hp. at 13,000 r.p.m. One of the faults discovered after running the gears a short time was a very pronounced burnishing effect on the face of the teeth. After being analyzed, it was finally decided that this defect was due to slippage. To obtain the rate of slippage, therefore, the following graphical method was devised.

The greatest amount of slippage occurs at the point of contact which is farthest from the pitch point, and this point may be readily found by the following construction: First, as shown in the accompanying illustration, the line *NN* is drawn through the pitch point *C* making the angle θ (equal to 90 deg.—the pressure angle) with the line of centers OO_1. This line is called the line of obliquity and on it lie all points of contact. The path of contact, therefore, must be somewhere on this line. Its limits are found at its intersection with the addendum circles and give *DA* for the path of contact.

Due to the difference in the diameters of the two gears, the path of contact in approach *DC* is greater than the path of contact in recess *CA*. For this reason, we will use the point of contact *D* and we will now find its linear velocity on the gear *B*. Taking the distance O_1D (which is the addendum radius) and multiplying it by 2π x r.p.m. of gear *B*, we get the linear velocity of *D* in inches per minute. Representing this velocity by a vector in its true direction which is perpendicular



A GRAPHICAL METHOD OF FINDING THE RATE OF GEAR TOOTH SLIPPAGE

to DO_1, we have *DH*. Now resolving this velocity into its components along the common normal and the common tangent *TT* perpendicular to *NN*, we have the lines *DF* and *DK* respectively.

The next step is to find the linear velocity of *D* on gear *A*. First, we have the true direction of its linear velocity which is perpendicular to radius *OD*. We also have its component along the common normal, since this normal is the line of connection between the two sliding surfaces and components along the line of connection must be equal. A line drawn perpendicular to *DF* at *F* and cutting *DE* at *E*, gives the velocity vector *DE* of *D* on gear *A*, and resolving the vector for its component along the common tangent *TT* we get *GD*. The rate of sliding will be found to be *GK* equal to $DG + DK$ since the components along the tangent act in opposite directions. Measuring this distance with the same scale used for vector *DH*, we get the slippage in inches per minute at this point of contact. The slippage at any other point can be found in a similar manner.

This method also easily proves the fallacy of the common belief among practical men that due to the method of constructing the involute gear tooth, pure rolling contact is taking place at all points of contact. In order to have pure rolling contact there must be no slippage or no components of velocities along the common tangent. This condition will be seen to exist only at the pitch point where the velocity vectors for both gear *A* and gear *B* will coincide and be of equal length.

Novel Scale Holder—Discussion

By Elam Whitney

The holder for use with flat scales suggested by P. A. Daschke on page 702 would hardly be justified it seems to me. Triangular draftsman's scales can be purchased for less than the two machinist's scales. The draftsman's scale has the advantage of a beveled edge. Flexible steel scales are graduated on one side only, which would be a drawback to their use, on account of the number that would be required.

Locating Racks in a Milling Machine Vise

By R. A. Follensby

We had several hundred racks to be cut, 14 pitch, 64 teeth, and we were cutting them three at a time in a heavy manufacturing milling machine by means of a gang of three cutters that cut the whole number of teeth at one pass. One cutter of this gang cut 18 teeth in the racks and the others 20 and 26 teeth respectively. The cutter cutting 18 teeth became so badly broken that we could not continue and we decided to cut the remaining racks in two operations instead of incurring the expense of a new cutter.

The special vise in which the work was held is shown in end section in Fig. 1. The bolster *A* was held to the vise body by means of large fillister head screws and the fixed jam *B* was similarly attached to the bolster. There were two moving members *C*, which were nicely fitted to slots in the body of the vise and held against lifting or tilting under pressure by the bolster.

Each moving member had bolted to it, by means of collar-head screws from the outside, the movable jaws, one of which may be seen at *D*. Independent screws, not shown in the sketch, applied the holding pressure to the work.

After the cutter had broken the remainder of the racks were cut by the other two, making 46 teeth in each. We then devised the gage shown in Fig. 2 to reset them for cutting the rest of the teeth.

Two pieces of steel *E* and *F* were fitted together in the form of a try-square, with tongue and groove at the

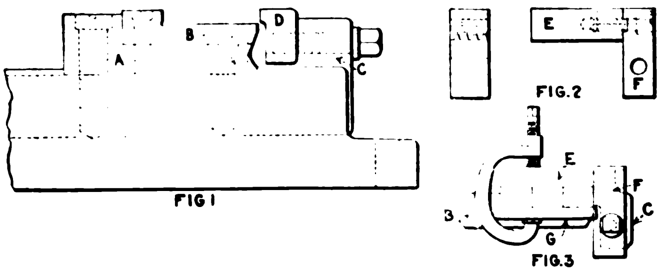


FIG. 1—END SECTION OF WORK HOLDING VISE. FIG. 2—THE LOCATING GAGE. FIG. 3—METHOD OF ATTACHING GAGE

joint and dowel pins for convenience in putting them together. A fillister head screw let into the piece *F* held them together.

After the gage was fitted up and checked for squareness, it was taken apart and rack teeth, corresponding to those in the work, were milled lengthwise of the under face of part *E*. It was then reassembled and fastened in position against the end of the movable jaw *D* of the vise.

With three of the racks in position in the vise and located lengthwise by the teeth of the new gage, the machine was set to cut the remaining teeth in the work by allowing two or three teeth of the cutter to overlap those already cut in the racks and adjusting the table of the machine until the two groups of teeth were accurately engaged.

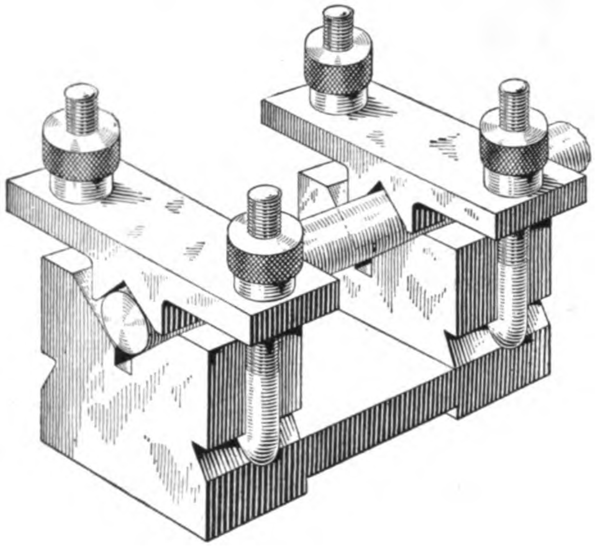
The method of locating the gage on the vise is indicated in Fig. 3, where a partial end view of the latter is shown with three racks in position and the gage held in engagement with them by means of the light clamp while the locating hole was laid off and drilled. The piece *G* was used merely to secure a firm bearing for the clamp across the bottoms of the racks.

Improved V-Block for Drilling

By E. Lytton Brooks

The V-block shown was designed for drilling through holes, as the ordinary straight block lends itself so readily to being drilled into and mutilated at the bottom of the V when the drill goes through with a rush.

The cut away blocks offer no difficult machining problems, and are well worth the making, as they are easier



TOOL MAKER'S V-BLOCK

to handle than an ordinary pair. Two grooves are machined along the bottom to facilitate clamping, and the style of clamp was chosen because it does not foul the drill chuck like the long center screw pattern. Both the block and clamp plate were made from tool steel, hardened and ground to finish. A slight clearance was ground out on the underface to allow the blocks to bear on the ends.

Fitting Hammer Handles

By H. K. Griggs

Much has been written about hammer handles and several devices have been shown to secure the handles in hammers.

A good hammer should have a double taper eye and the handle should fit on the under side of the eye. This is important. After driving the handle as far as possible into the hammer, saw the handle off flush with the outside. The piece sawed off usually provides material to make one or two hard wood wedges. With a thin pointed chisel make a diagonal split in the outer end of the handle. Dip the wedge in glue, drive it in and saw off flush.

Uusually if the handle is fitted properly one wedge is enough, but more can be used if required. Handles thus mounted seldom get loose unless alternately exposed in wet and very dry places. If any looseness is detected another wooden wedge can easily be driven in and if dipped in glue will not get loose. The chief cause of loose handles is that they were not properly fitted in the first place. This being so, no device will keep them tight. The fitting of hammer handles might well be under the control of the safety department in shops large enough to have one, for loose handles are a constant source of danger.

Editorial

WE ADMIRE THE MAN who has the ingenuity and go-get-there spirit to tie his jackknife to a beveled piece of wood and plane a board with it when his wife gives him a job and he has no plane, but we refuse to hire him when we have a real job of carpentry to be done. We want a man *and* his tools. Then why tolerate makeshifts in a shop where real jobs are in order all the time?

Another Abuse of Service

THE PROBLEM of what passes for service, but which is frequently unalloyed nerve on the part of the purchaser, bobs up again and again. Just as an instance of the demands a buyer will make, we cite a case of rather recent date.

The production end of a large plant finally decided that new equipment was needed. They were not sure which tool was best so they wanted to be educated, at the expense of the maker of the machines. So they proposed to several machine tool builders that they send a machine and an operator for three months' trial on their work, the successful machine to get a nice order for quite an equipment. As usual, the builders fell for it, some only part way to be sure, but others all the way, as the entire expense was supposed to be borne by the makers of the machines.

When you analyze this proposition it stands out as a bold bid for educating a production department at the expense of several builders of machines. They do the experimenting as to the best machine and the best tools for this work. They give their experience, the time of their men, the product of their machines and three months' wear, for the education of the production department of the concern which may buy several machines when their education is complete. It is cheap education for the buyer, but expensive for the machine tool industry as a whole. Furthermore, it is absolutely unfair to the buyer who knows what he wants, who does his own experimenting and who has production men who know the best methods of doing work.

If the buyer were willing to pay for his education, as he should, there would be no harm in such a proposition. But the machine tool builder must cover the cost of this so called service in the price of the machine, and the man who does not require it has to pay just as much as the man who must be educated.

The fair method would be to have a flat price without service, and a reasonable charge for all service rendered. It will, of course, be difficult for the builders to enforce such a rule unless all determine to stop the present practice. This can hardly be done until the service abuse is allowed to grow to unbearable proportions. The remedy may have to come from the other side, by the buyers who do not need service or education absolutely refusing to pay the same price as the man who does. Neither remedy is easy of accomplishment, but there is a growing feeling that a change is inevitable and not far distant.

Small Tools Are Small in Size Only

NO MACHINE is better than the tool used in it. If we accept this truism we may expect every manufacturer to be everlastingly on the qui vive for the best tools and constantly trying to make them still better. There are such manufacturers, we are happy to concede, but there are more who are everlastingly trying to reduce the cost of small tools and shutting one eye to the results. The other eye is cocked at the happy reduction in expenses brought about through charging small tools to this class of disbursements.

Costs of small tools are expenses. Expenses should be held down to a minimum—a mighty good rule, by the way—and so everything possible is done either to reduce the expenditures for small tools or else to make them disappear in some mysterious way in the maze of shop rules and bookkeeping.

If Mr. Manager had kept both eyes open he would have seen something more than a reduction in expenses. In fact, he would have seen that there was no reduction at all, but rather the opposite. It takes two eyes to get perspective.

The second eye would have seen a reduction in output or to put it differently an increase in labor cost. Maybe there has been no increase because labor costs always were too high on account of poor tools. Suppose that a tool costing \$5 turns out the product at a cost of \$100 while another tool costing \$10 produces the same work for \$50. Which is the cheaper tool is easy enough to see when one has the figures, but the man who does the work with the so-called cheap tool probably has no idea what might have been accomplished with a good one and so he continues saving pennies on the tool and wasting dollars on the work.

Then, too, if the poor tool is made in the plant the chances are 10 to 1 that it does not cost less than a good one—it only seems to cost less. The amount of juggling one can do with labor, material and especially overhead, intentionally or not, is something surprising. A home-made tool believed to cost \$5 might easily cause a loss of \$10 per piece if made in quantities and sold for \$20.

If a home-made tool were good and cheap it would be more than welcome; if it were good but expensive it would be acceptable; if it were cheap but not very productive, it might be tolerated if there were only one of its kind, but if it slows down production all over the shop, it becomes a nuisance. And that is exactly what poor tools do, whether they are made at home or outside. A home-made drill of inferior quality slows down not only the machine on which it is used but every machine in its neighborhood.

But is there reason to think that a home-made tool is of poorer quality than the standard commercial article? In answer we can only ask questions. Would you expect to build an electric motor as good as one you can buy, and would you shave yourself with a home-made razor before trying it out on somebody else? Have you the equipment, the material, the facilities and espe-

cially the knowledge of the man whose sole business it is to make tools?

And then there are the makeshifts. It is bad enough when you make a tool just like any other of its kind, only not quite so good, but when you make makeshifts you act in very much the same way as if you were regularly going through the movements used in resuscitating a half-drowned man every time you breathe.

Worst of all is it to keep a defective tool rather than buy a new one, to reduce the output of a $4,000 milling machine to one-third of its capacity because you hate to throw away a crooked arbor.

Don't forget that in the running of a machine shop small tools are small in size only.

The Machinery Market in South America

WITH FACTS and figures which are striking, the November issue of *Commerce Monthly*, the trade organ of the National Bank of Commerce of New York, calls attention to the favorable position of the United States with respect to future trade with South America. It stresses the valuable relationships which have been established and points out the great improvement which has been made in shipping facilities since 1914.

In the period from 1910 to 1913 it is shown that but 15 per cent of the southern continent's total imports came from the United States. By 1917, due to the great impetus given foreign trade generally as a result of the war, South America reached a point where 46 per cent of her needs were supplied by America. That the post war depression has had but little effect on the trade established, is shown in the imports for 1920 which show the United States still greatly in the lead and supplying 42 per cent of the total.

The South American export trade with the United States is no less striking. Before the war she sold us 20 per cent of her outgoing products. In 1917 we took 42 per cent and in 1920, 33 per cent of her goods. That we should hold the abnormal war position is hardly to be expected. Recent statistics, however, point clearly to the fact that future trade with South America will be permanently larger than ever before.

There is a lesson in these general statements for *American Machinist* readers. South America today is closer to us than she has been at any previous time in history. On the one hand, American travel thither and study on the ground has brought about an appreciation, not only of the vastness of the continent, but of its tremendous possibilities. On the other hand, clear thinking and far seeing people in those southern republics have derived an inspiration from the example set them by their northern neighbor. History is repeating itself. To those republics, as has been the case in America, expansion has come to mean nationalization and nationalization has brought about strength and elevation of view. Not only are they advancing their frontiers, but the ground already conquered is rapidly being made, in each republic, the scene of an intensive agricultural and industrial development.

The tool manufacturer will do well to give thought to this market. The various republics in 1910 bought $305,069 worth of American metal working machinery. In 1917 their purchases from us for this class of goods more than doubled, reaching $795,449. By 1920, in the face of a worldwide depression and depreciated exchange, the figures reached $1,764,419, more than five times those of 1910.

The future in South America for the machine tool industry of America is one of great promise. An era of industrial and economic development, of railway and power expansion, understood and appreciated by but few, is not merely conceived but actually under way.

The Personal Element in Precision Grinding

PRECISION grinding is an operation in which the individual skill of the operator counts for much. There are so many factors entering into the production of perfect work that personal skill is always likely to be at a premium in work of this kind.

We recently dropped into a little shop with a large reputation for good work and found it busy, as usual, not on ordinary, low priced contracts but on a lot of shafts for an automobile transmission which had to be *right*. These shafts were from the shop of one of the best known quality cars in the country. They were not sent out to this small shop to save money but to secure a better pob than the factory could obtain with the best grinding equipment money could buy. The factory had the machinery and it had good men, but they were not good enough to get the very best results, which they desired.

Two men, experts in grinding, run this little shop and are reaping the rewards of long years of careful study and experience in grinding. They have good grinding machine equipment of course, the same as the automobile shop has, but they have more; they have the personal skill and knowledge which enable them to get just the right results. They know the right wheels to use, the proper fit of bearings, the importance of proper dressing of the wheel and many other points that have a bearing on the product.

There is a growing demand for better grinding and with it is coming the opportunity for men who really know modern grinding machines and grinding practice. We can think of no more promising field for young mechanics who are ambitious to excel in their chosen field.

Just Suppose

JUST SUPPOSE somebody came to you and told you that you might get much better results in the shop by making certain changes which had been tried out by A.B.C. and X.Y.Z. and found to work well; wouldn't you naturally tell him that you know your own business best and that, anyhow, your conditions are different and that such schemes may be all right in some shops but not in yours? No, sir! not in yours.

And now suppose your friend comes to you and says that he gets much better mileage out of his Vix tires than out of the Nix brand you use, recommending at the same time a carbureter he has tried out with glorious results and a spark plug which will spark when the battery is nearly dead. Wouldn't you just naturally tell him that you know best how to run your own car and that, besides, those things may be all right on his car but that they would never work on yours?

Of course not. Nobody is as big a fool as that, but when it comes to running a shop—that's different. Sc it is, but—

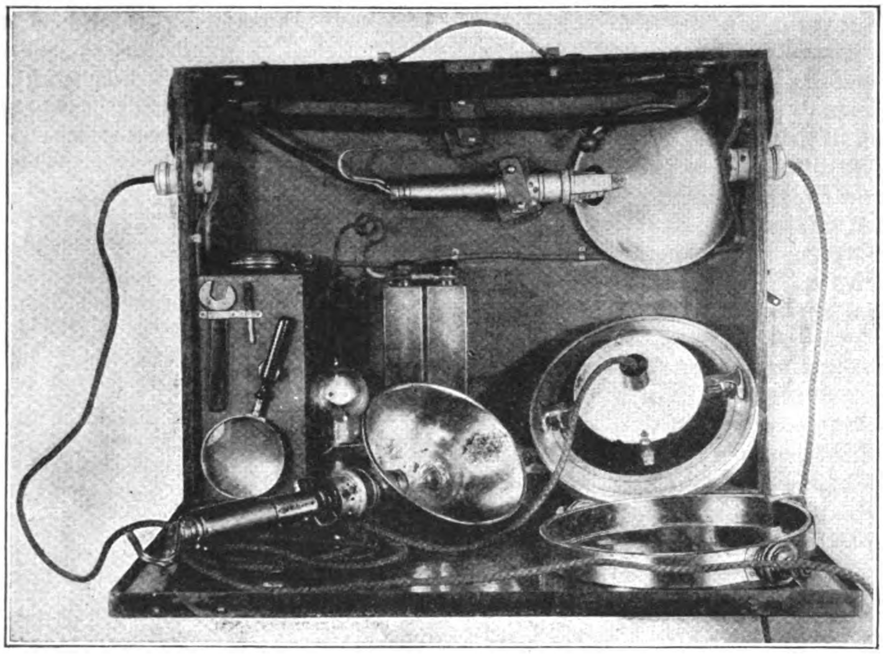
Just suppose.

Shop Equipment News

Elverson Oscilloscope

The Elverson oscilloscope is an optical-mechanical device for visually slowing the motion of rapidly moving mechanisms so that an observer can easily study just what is taking place. The apparatus, which is shown herewith in portable form, is built by Herbert Kennedy & Co., Ltd., London, England, whose representative, Peter Davey, is at present in this country and located at the office of John H. Faunce, 8 Bridge St., New York, N. Y.

The mechanism consists primarily of a commutator, shown on the right side, which flashes a lamp or lamps, so as to synchronize with the motion of the object to be examined. These lamps are specially designed and constructed so as to give an instantaneous flash, such as cannot be obtained with a filament. They are filled with neon gas, through which a discharge takes place from one electrode to the other. They have the peculiarity of improving with age. The commutator referred to is in reality a special form of gear box driven direct from the mechanism to be studied. In this gear box are contact breakers operated by means of cams, which control the flashing of light. Current for the lamp comes from a small 4-volt storage battery, through special coils and condensers, making the instrument independent of outside connections. On the gear box is a switch plate by which the operator can make the object appear stationary or moving at one per cent of its normal speed. A part moving at 1,000 r.p.m. seems to move but 10 r.p.m., so that its motion can be easily studied. There are also two sides which give two or four flashes per revolution, for use in studying vibrations or gyrations in rapidly moving parts.



ELVERSON OSCILLOSCOPE MOUNTED IN A PORTABLE CASE

This gear box will control flashes up to 28,000 per minute, which means that almost every kind of high-speed machinery can be studied in action as though it were at rest. By moving the outer dial, which is graduated in degrees, the position of the object being studied can be varied, the graduations showing exactly the relation of the two observations. By this means the exact period of the opening and closing of a valve, or a similar period in any mechanical movement, can be accurately determined and the action visually studied.

For studying the periods of vibration the slides shown are of particular value. One slide controls the stationary and the other the creeping position. Pulling the slide out to the first notch doubles the number of flashes, and the second notch gives four flashes per revolution. As the gear box is driven positively from or in relation to the shaft being studied, increasing the number of flashes clearly shows whether or not the period is at shaft speed.

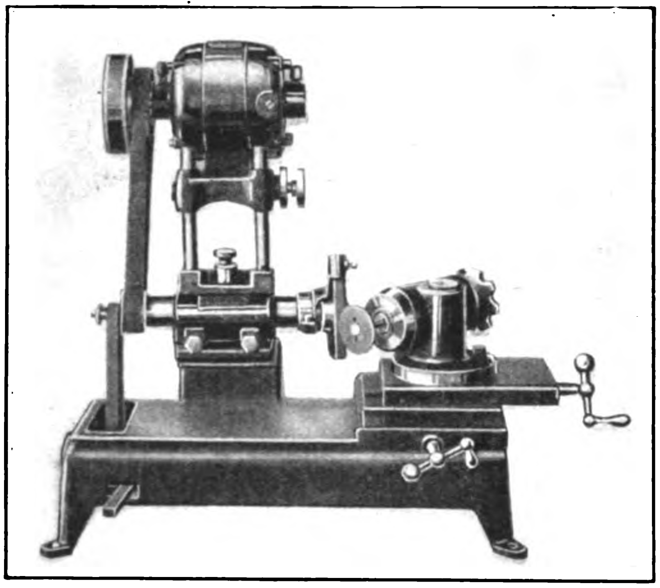
When the critical period is reached, two distinct images appear. If these appear with the double flash, the period occurs at the speed at which the shaft is running. If the double image appears when the flashes are four times the shaft speed, then the vibration period is at double the engine speed. Experience with the device will show many points of vital interest to designers of all kinds of machinery, especially that which runs at high speed. With the knowledge thus obtained showing exactly what happens under running conditions, defects can be detected and better machinery designed. The use of this device shows so much that could formerly only be guessed at, that its applications are very wide. Among some of its uses have been the detection of gas-engine valves which did not seat until after bouncing three or four times, of oil systems which were not functioning properly, of knot-tying machines which were not getting the correct motions, of the actual working of magneto breaker points and of the distortion of airplane propellers.

With the oscilloscope, designers and builders of automatic machinery of all kinds, can study the exact movement of any part under actual working conditions, which takes into account the deflection of parts, the rebound after a sudden contact, and many other points of vital interest. It is not necessary to have a dark room in which to operate the machine being tested, although direct light should be cut off. The intensity of the light from the oscilloscope is sufficient to give the illumination necessary. The observer needs no auxiliary apparatus through which to view the mechanism under test, as its action is evident to the naked eye.

Sapihl Portable Electric Valve and Toolpost Grinding Machine

An electric-driven portable grinding machine having a wide range of uses has recently been placed on the market by the General Tool & Equipment Co., 70 Monroe St., Chicago, Ill. The tool, which is designated as the Sapihl portable electric grinding machine, is adapted to general use.

The chief feature of the device is that all running parts are equipped with ball bearings, both in the motor and in the wheel and work spindles. The accompanying illustration shows the device arranged for grinding the poppet valves of automotive engines, with a valve held in place in the chuck. The chuck can be indexed to give any angle desired to the valve, and it is mounted on a compound slide so that it can be both traversed across the wheel and fed in toward it.



SAPIHL PORTABLE ELECTRIC GRINDING MACHINE

The work-carrying spindle is rotated by means of connections from the grinding spindle, although it can be disengaged while the motor is running. The reamers for machining the valves in the motor block can also be sharpened in the machine, thus insuring that the same angle is obtained on both the valve and the seat.

The motor and spindle unit can be detached from the base and employed separately on machine tools for light grinding operations. It can be readily mounted on the toolpost of a lathe for performing both internal and external grinding. The motor is driven from a convenient lighting circuit, so that it may be attached wherever a lighting socket is available. It is controlled by means of a snap switch on the cord. It is adjustably mounted on the two upright bars, and can be raised by means of a knurled screw for tightening the belt, and then clamped.

The spindle is mounted in double-row S. K. F. self-aligning bearings. The height of the spindle can be varied by means of an adjusting screw. Both internal and external work can be done, extension spindles being furnished for the latter. A heavy extension spindle can also be furnished for large internal grinding.

The machine can be employed as an ordinary abrasive wheel for the general uses required around the shop, such as sharpening tools and grinding contact points.

"Marvel" No. 2 Portable Motor-Driven Draw-Cut Hacksawing Machine

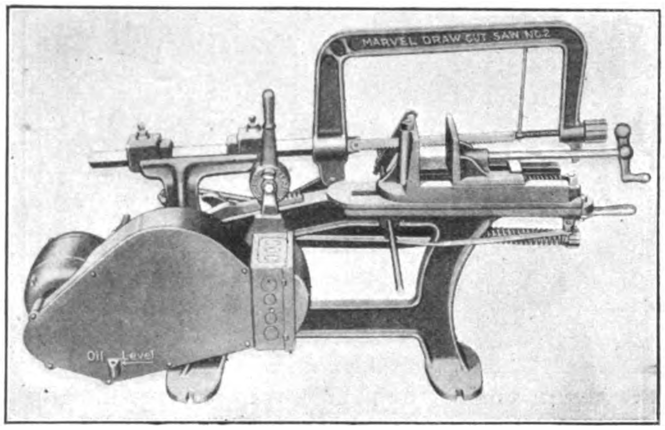
The Armstrong-Blum Manufacturing Co., 333 N. Francisco Ave., Chicago, Ill., has recently placed on the market a portable motor-driven style of its "Marvel" No. 2 draw-cut hacksawing machine. The machine, which is similar in general characteristics to that described on page 215, Vol. 40 of *American Machinist*, has a capacity for work 6 x 6 in. in section on long stroke, and 8 x 8 in. on short stroke. Blades from 12 to 17 in. in length can be used.

The motor is attached to the rear of the machine, so that the chips from the saw do not get into it, and it is connected by means of a silent chain to the driving crankshaft. The gears, sprockets and chain are entirely inclosed in a cast-iron housing, and run in oil. The motor is of ½ hp. and can be furnished for the style of electric current that is available, for either power or lighting circuits.

When the machine is furnished with a motor that can be operated from a lighting circuit, a plug receptable is attached to the top of the switch box, so that the motor can be easily connected to any available lamp socket by means of an extension cord. In this way, the machine can be moved to the place where the work is to be done, and connected to a convenient lighting circuit.

The portable feature is of particular value when work is being done on structural or ornamental iron, on sheet metal, or on parts that cannot be easily transported in a garage or machine shop. The whole machine can be mounted on a small platform truck, so that it may be moved to any part of the plant where a job must be done. This truck mounting is particularly useful for maintenance and millwright departments.

An inclosed externally operated fused switch is attached to the front of the gear housing, and all wiring between the switch and the motor is inclosed in conduit.



"MARVEL" NO. 2 PORTABLE HACKSAWING MACHINE

The starting handle on the front of the machine is connected to the switch so that the method of operation is just the same as that of a belt-driven machine. The motor and the machine are started by moving the handle to the left, and they are stopped by moving it to the right. Thus, no clutch is required. When a cut is completed, the saw frame trips the starting handle and automatically opens the switch and stops the motor.

The vise holding the work is only 19½ in. from the floor. The length overall of the complete machine is 52 in., while the extreme width is 18 in. The machine weighs 350 lb. net, and 450 lb. when crated for shipping.

Towmotor Model C Gasoline Industrial Tractor

An industrial tractor driven by a gasoline engine and capable of general use about a machine plant has reecntly been placed on the market by the Towmotor Co., 1226 East 152nd St., Cleveland, Ohio. The accompanying illustration shows the Model C machine, which has a normal drawbar pull of 1,150 pounds.

One of the principal features of the machine is the small turning radius, as the minimum outside turning radius is only 5 ft. 3 in. The machine is driven by the two rear wheels and steered by the two front ones. Cast-steel disk wheels fitted with Timken bearings are provided. The tires are solid rubber; the front ones are 16 x 3½ in., and the rear 22 x 3½ in. double.

A four-cylinder, four-cycle motor stated to deliver 23 brake horsepower at 2,000 r.p.m. is employed. A battery is mounted under the truck for ignition and for operating the starting motor. A thermo-syphon cooling system is provided. The 6-gal. gasoline tank feeds by gravity and is located in front of the driver. The clutch has a single plate, and the transmission one speed forward and one reverse.

Fabric universal joints are placed between the transmission and the rear axle, which is of the internal-gear-driven type. It is full-floating, runs on Timken bearings and gives a speed reduction of 8 to 1. The frame has a depth of 9½ in. and rests on semi-elliptic springs at both the front and rear. Brakes of the internal-expanding type are located on the rear wheels. The machine has a speed from 1 to 8 miles per hour.

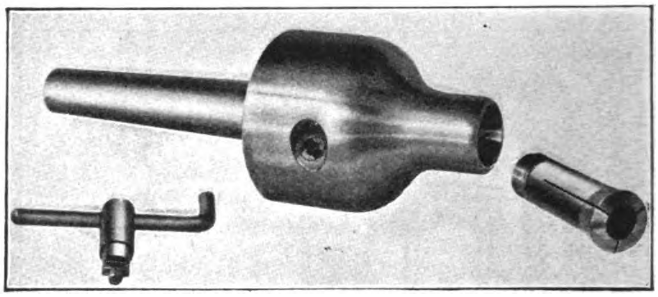
TOWMOTOR MODEL C GASOLINE INDUSTRIAL TRACTOR

Bumpers made of ⅜-in. steel plate are provided at both front and rear for the full width of the chassis. These bumpers give protection to the vital parts of the machine and serve for pushing operations. Couplings on both the front and rear are adjustable for height. The wheel base of the machine is 40 in. Its overall length is 72 in., and the width 40 in. It weighs about 2,900 pounds.

Rockford Milling Machine Co. Spring Collet Chuck

A chuck for holding spring collets has recently been placed on the market by the Rockford Milling Machine Co., Rockford, Ill. The device is intended for gripping small rods, straight shank drills, milling cutters and parts that are to be rotated in a spindle.

As the accompanying illustration shows, the chuck consists of a body to which is attached a shank at its rear end and which has a tapered hole at the front end. The collet fits the tapered hole in the nose of the chuck and is drawn back in place by a wormwheel threaded on the inside to fit the threads on the end of the collet. It can be quickly moved in and out by turning the worm with the key wrench. Turning to the right draws the collet against the taper and closes it uniformly from all sides. Turning to the left forces the collet out.


ROCKFORD SPRING COLLET CHUCK

The small nose on the collet makes it possible to bring work very close to the chuck. The shank of the drill or milling cutter is gripped throughout almost its entire length, so that rigidity is increased and the tendency to crystallize and break the cutter is reduced. There are no projecting parts to catch the hands of the operator.

The device is made of hardened and ground alloy steel. The shank can be furnished to fit any spindle of standard taper. The chuck is adapted particularly to lathe as well as to milling machine use, as when gripping stock no draw-in attachment is necessary. The chuck is ordinarily made in three sizes having B. & S. tapers of 9, 10 and 11, respectively. Collets up to 1 in. in diameter can be held.

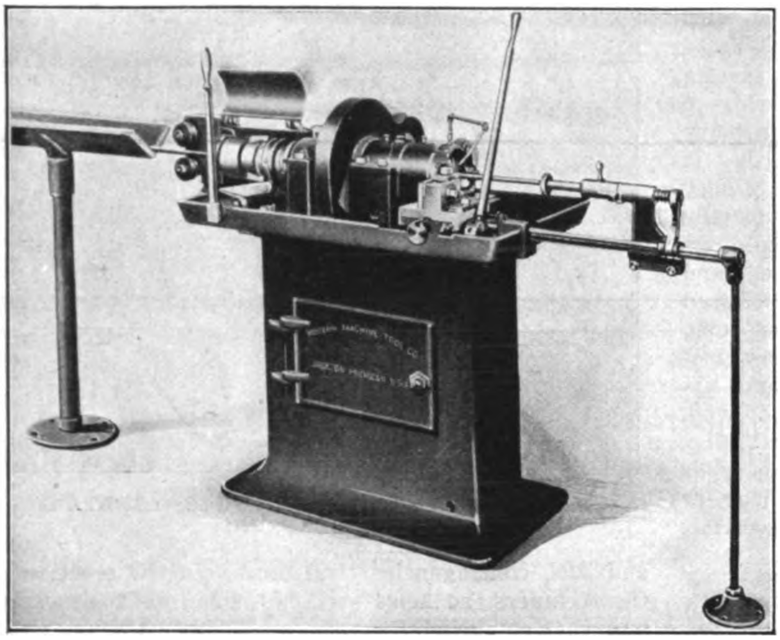
Changes in "Modern" Cutting-Off Machine

The cutting-off machine made by the Modern Machine Tool Co., 601 Water St., Jackson, Mich., for cutting pipe, tubing and solid bars, both round and hexagon, has recently been altered in design so that it appears as shown in the accompanying illustration. The specifications and general dimensions of the machine are the same as formerly, as it is made in sizes having maximum capacities of 1, 2 and 3 in. outside diameter.

The principal changes lie in the method of handling the stock and the positions of the control levers. Although the No. 1 machine is equipped with the roll feed, such as formerly used, the two larger sizes are now provided with a double live roller feed for feeding the stock through the spindle. An automatic stop is provided on all sizes of the machine for gaging the length of the piece being cut.

The stop for the stock is operated from the tool

block. The arrangement is such that as the toolblock is moved out to clear the tool after the cut, the last part of its travel moves the stock stop about 3/16 in., and brings it up to position for properly locating the work. As soon as the toolblock is fed in to start the cut, a spring causes the stop to move back clear of the work



"MODERN" CUTTING-OFF MACHINE

again. In this way the stop does not wear due to the rotation of the work, and the work itself can drop away from the tool after it is cut off. A stop pin is arranged so that the operator can tell when the tool is clear of the work.

The double live roller feed for feeding the stock through the spindle is driven through a worm and gears from the cone pulley shaft. As the machine is slowed up to accommodate large stock, the feed is also slowed. The feed rolls run continuously. They are so trunnioned and connected with the lever operating the collet that the movement opening the collet brings the rolls simultaneously up to the stock. A further slight pressure on the lever feeds the stock through the spindle against the stop. The back movement of the collet lever throws the rolls clear of the stock and closes the collect.

The lever controlling the collet is placed in a vertical position, and the mechanism altered so that movement is much easier than in the former model. In running the machine, it is not necessary for the operator to remove his hands from the two levers. A pull of the left hand on the collet control lever opens the collet and feeds the stock through the spindle up to the stop. A push closes the collet; and on stock up to 3 in. in length of small diameter there is no perceptible wait for the feeding of the stock.

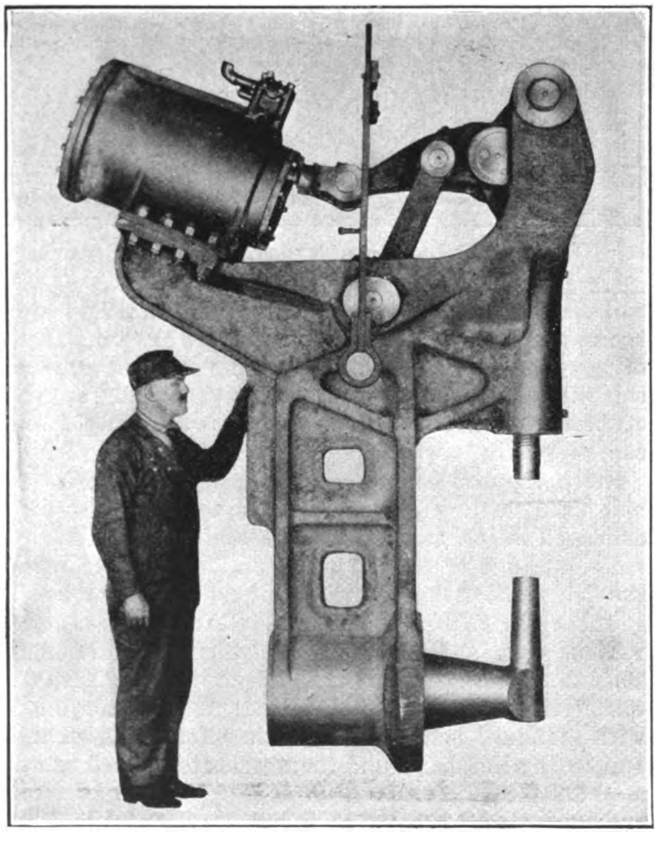
A movement of the right hand on the tool feed lever then causes the tool to feed into the work. When the cut is finished, the reverse movement of this lever pulls the tool from the work and brings the automatic stop into place ready for positioning the next piece. Since a very large number of pieces are cut off per hour, the economy of effort and time on the part of the operator is of considerable importance and enables an increase in the rate of production of the parts.

Hanna Last-Head Boiler Riveting Machine

The Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., has just completed and shipped the large riveting machine shown in the accompanying illustration, for use when riveting through the manhole the last head in a boiler. The reach of the unit is from 14 to 18 in., and the gap 35 in. The capacity is 1,000 tons. The machine may be arranged with either a straight-push hydraulic actuating mechanism, or with the Hanna pneumatic mechanism. The diameter of the cylinder is 18 in., and the stroke of the die 5¾ inches.

The machine is arranged for portable use in two positions, and suspension is made with the dies vertical. It swivels about a point close to the center of gravity, so that the stationary die can be swung on and off the manufactured head of the rivet in a direction very nearly parallel to the line of travel of the die. The mass or weight of the riveter is thus not lifted nor lowered during riveting.

The distance from the center of the beam stake, which is of forged alloy steel, to the end face of the die standing thereon is 30 in., allowing a 60-in. shell to be accommodated. The length of this die can be varied in conjunction with the opposite die to take care of shells as small as 42 in. in diameter. The distance from the axis of the dies to the long face of the throat is 16 in. The machine is used on high-pressure containers, in which the rivets are 1¼ in. in diameter and the plates 1½ in. thick, requiring a heavy machine. It has a weight of 9.900 pounds.



HANNA LAST-HEAD BOILER RIVETING MACHINE

Midwest Box Rails and Steel Stringers

In order to give speed and ease of installation when erecting mechanical equipment, particularly overhead members such as lineshafts, a system of anchorage material in the form of rolled steel sections designated as box rails and steel stringers, is now being manufactured by the Midwest Steel & Supply Co., Inc., with general offices at 28 West 44th St., New York, N. Y.

The box rails are a sort of continuous socket insert; a good idea of them can be obtained by referring to Fig. 1. They are considerably heavier than the ordinary socket inserts, and have a cross-sectional area that is considerably greater, so as to give strength. They can be furnished in any length required, and are usually built into the ceilings or walls of concrete buildings during erection. A surface slot is left exposed, and through the use of a special bolt which can be slipped into the slot at any point and given a quarter turn, anchorage support can be provided for machinery, motors, transmission lines, sprinkler systems and apparatus that need be supported from the ceiling or wall.

The rail can also be employed for supporting trolley beams for monorail conveyor systems, in the side walls of buildings for carrying crane rails, and in the floor for mounting large presses and machinery. Sections of box rail can be inserted vertically into side walls of storerooms and stock rooms, and brackets for carrying shelves or bar stock can be clamped to them The advantage of this method of installation is that practically any type of bracket can be used, and the space between them can be readily varied.

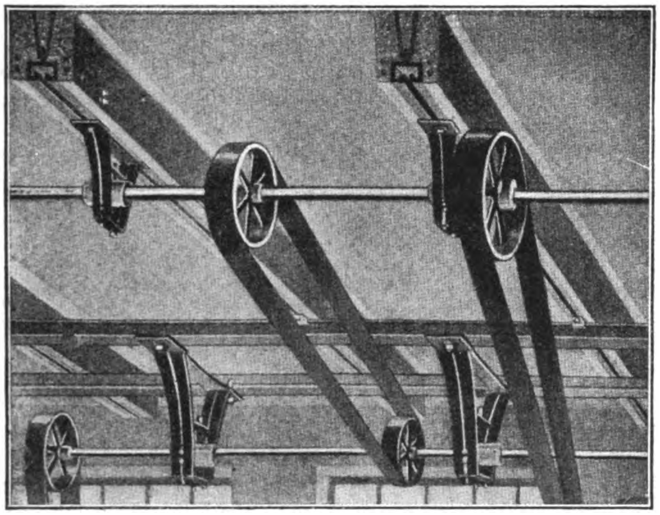


FIG. 1—MIDWEST BOX RAILS IN POSITION

Since the box rail is usually installed with its outside face flush with the concrete or brick, it can be employed as a base for electric motors. It thus provides a range of adjustment sufficient to take care of the belt slack without cutting out a piece of the belting.

The steel stringers are also rolled steel sections of various sizes, and can be furnished in even foot lengths. They are more directly related to the intallation of machinery and transmission lines, and in conjunction with standard bolts and clips they form a system for supporting lineshafts and countershafts, as well as other mechanical equipment. Fig. 1 shows a pair of stringers supported by bolts in the box rails, while Fig. 2 shows the stringers attached to overhead I-beams and carrying smaller cross stringers. The stringers are adapted to any type of building contruction, as they are attachable to either wooden or steel girders.

One of the principal features of the system is its flexibility, as adjustment in either direction is provided, and units can be added, taken away or re-positioned to take care of additional equipment, changes in location and such contingencies that arise. In the erection of the stringers, no holes need be made, nor tools except wrenches employed.

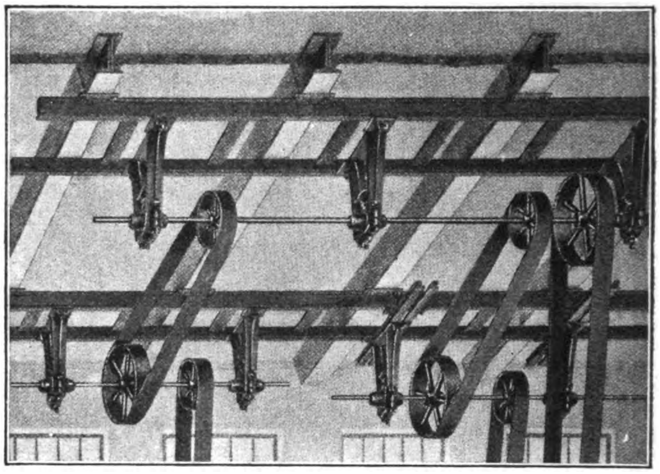
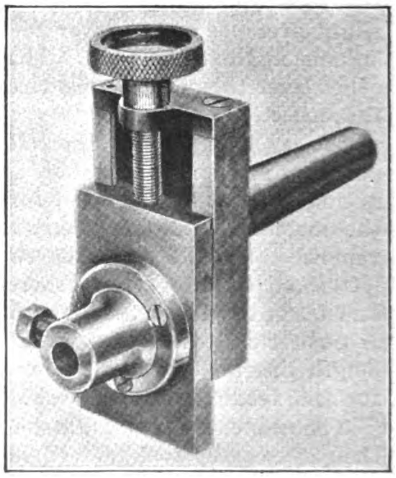


FIG. 2—MIDWEST STEEL STRINGERS CARRYING LINE SHAFTING

Industrial plants can carry assorted lengths of steel stringers in stock to provide for emergencies such as breakdowns or the erection of temporary countershafts. In this way, the steel stringers can be employed instead of wooden ones. Of course, they are not affected by shrinkage or warping under varying temperature conditions, as are the wooden stringers.

Bruce Precision Eccentric Boring Head

The Precision & Thread Grinder Manufacturing Co., 1 South 21st St., Philadelphia, Pa., has recently added to its line the Bruce precision eccentric boring head that is illustrated herewith. The tool is intended especially for application to drilling and milling machines when boring jigs and fixtures, and also when index boring. The two members sliding on each other are provided with a gib to take up wear. One member carries a shank to fit the spindle of the machine, and the other an adaptor to hold the cutting tool. The eccentricity of the tool can be varied by means of the micrometer screw.

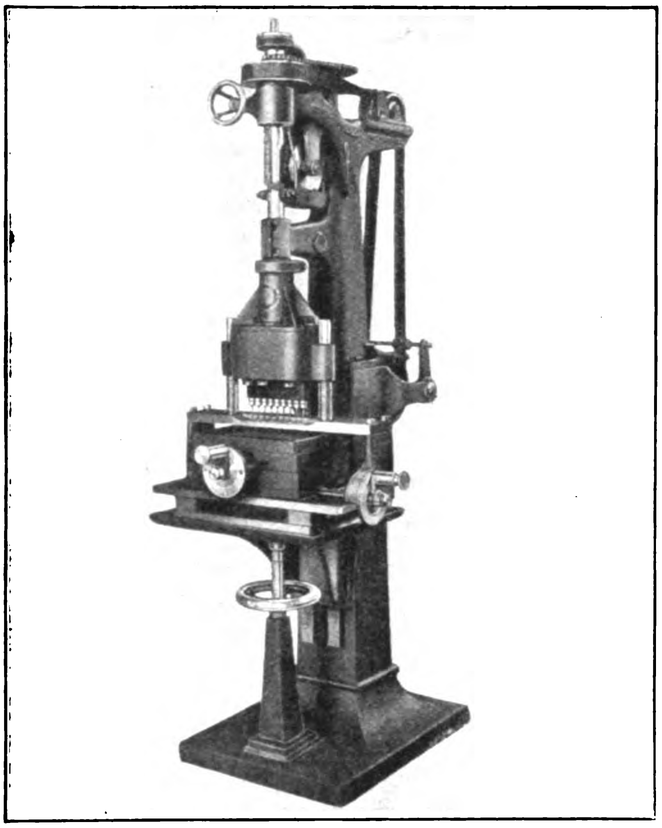


BRUCE PRECISION BORING HEAD

The head is made in four sizes, the capacities being, respectively, $\frac{3}{8}$ to $1\frac{1}{2}$ in., $\frac{1}{2}$ to $2\frac{1}{2}$ in., $\frac{3}{4}$ to 4 in. and 1 to 6 in. The adaptors furnished with each size permit of holding different sizes of drills, so that the tool can be used for both drilling and boring.

Hoefer Special Ball-Bearing Multiple-Spindle Drilling Machine

The machine shown herewith has recently been developed by the Hoefer Manufacturing Co., Freeport, Ill., to provide both speed and accuracy on light drilling work of a certain class. The work shown on the machine is a die plate employed in the manufacture of accounting machines for punching the cards, although with modifications the machine can be employed for other work of a similar nature.



HOEFER SPECIAL MULTIPLE DRILLING MACHINE

The machine itself is the regular high-speed, ball-bearing drilling machine made by the concern. It is equipped with an automatic cam feed and return motion, so that practically the only work required of the operator is indexing the jig and replacing the drilled parts. The head itself is heavy enough to maintain alignment of all the parts. It has nine drilling spindles, all driven from the main spindle of the machine. It is counterbalanced by a weight in the column, but springs are also added between the head and the die plate to assist in raising it after the cut has been made. The springs can be seen on the two hardened guide rods that keep the head and the jig in correct alignment relative to each other.

The work is located by means of dowel pins on the upper table of the indexing jig, which is provided with an oil basin for cutting compound. The pins aid in properly replacing the work, should it be necessary to remove it. The work-holding table is placed on the compound table of the machine, so that it can be moved both longitudinally and transversely. The pitch of each screw is such that one turn moves the table the exact distance between the holes in the work. Across the top of the jig there is a heavy steel plate in which are located the liner and the slip bushings which guide the drills. The guide rods for the head are also secured to this plate. The arrangement is such that the plate does not interfere with the movement of the work and the compound table.

The die plate being drilled in the illustration given is from $\frac{1}{8}$ to $\frac{3}{8}$ in. in thickness, and has 12 rows of 45 holes each. Since the holes are too close to drill adjacent ones, every fifth hole in a row is drilled at the same time, so that a row can be completed in five operations. The center distance between adjacent holes are not permitted to vary more than 0.0005 in. It is stated that the 540 holes in a plate can be drilled in 22 min., although from 3 to 4 hr. are required to drill them by means of a single-spindle machine.

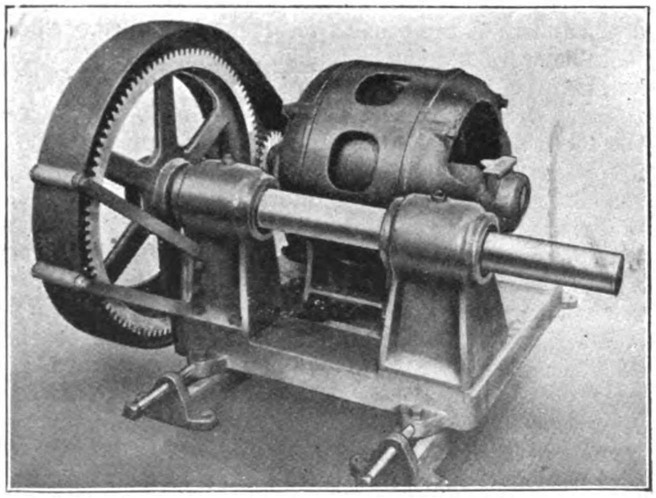
Motor Base with Speed-Reducing Gears

A cast-iron base for electric motors, having as an integral part a secondary shaft and speed-reducing gears, has been placed upon the market by the Bridgeport Motor Co., Inc., Bridgeport, Conn. It is intended for use in places where space is limited and where it is desired to drive a lineshaft directly from the motor without resorting to the extreme diameters of pulleys that would otherwise be necessary to obtain a large speed reduction with a plain belt drive.

The secondary shaft is mounted in two pedestal bearings having bronze sleeves and the ring oilers usual to motor construction. The driven gear is of cast iron and the motor pinion of rawhide, composition, fabroil or any other of the materials used for noiseless gear drives. Permanent gear guards form a part of the unit.

The smaller member of the secondary drive is keyed to the shaft opposite the main gear, and may be a plain pulley or a sprocket according to whether the drive is to be by belt or silent chain. The unit may stand upon or be suspended from cast-iron screw-adjusted guideways for floor or ceiling mounting, thus providing adjustment of center distances to maintain belt tension.

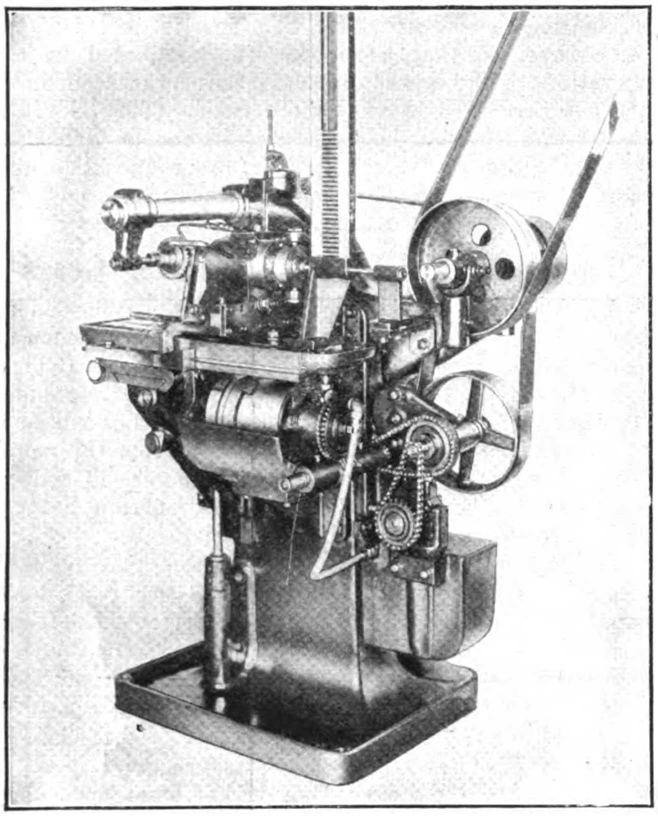
The unit is complete as shown in the illustration with gear, pinion and guards, but without the motor. It can be furnished to specifications to suit any standard make of motor from $\frac{1}{2}$ to 50 hp., and with gear ratios of 3, 4, 5, 6 or 7 to 1. Larger or smaller units or other gear ratios will be furnished upon order.



MOTOR BASE WITH SPEED-REDUCTION GEARING

"Standard" Automatic Milling Machine

The Standard Engineering Works, Pawtucket, R. I., has recently added to its line of milling machines a machine for automatically milling the squares on taps and other small work where a square is required. The



"STANDARD" AUTOMATIC MILLING MACHINE

machine, which is herewith illustrated, is fully automatic, having magazine feed and a mechanically opened and closed collet.

Two cutters are used on the arbor to straddle mill the work. After the first pass the work is withdrawn from between the cutters and automatically indexed 90 deg.; and then the other two sides are milled. An adjustable work stop is provided which insures the same length of cut on all pieces of a lot. The work when released from the collet falls on an inclined screen on the table, from which it rolls into a chute which carries it to a box on the floor.

The drive is from a countershaft to the rear shaft of the machine by a 2½-in. belt. Power is transmitted to a jackshaft directly below the rear shaft, then through a silent chain to the worm and wormgear to the drum cam, which has a pathway cut to move the table.

The spindle is mounted in phosphor-bronze bearings with means provided to take up any wear which may occur. It is driven by a 3-in. belt from the rear shaft. A crank is provided by which the machine may be turned over by hand when setting up. One man can operate three machines, as all that is required is to keep the magazines full. The normal production on ⅜-in. stock is stated to be 500 pieces per hour per machine.

Oil is supplied to the cutters by a chain-driven geared pump running at a constant speed. The tank is located at the rear of the machine and the oil drains from the table through flexible hose back to the tank. The tank has two compartments divided by a fine mesh screen, so that only clear oil is drawn into the pump. One collet, a countershaft and wrenches are furnished as regular equipment. With the equipment, the weight of the machine is 1,200 lb. The floor space occupied is 27 x 38 inches.

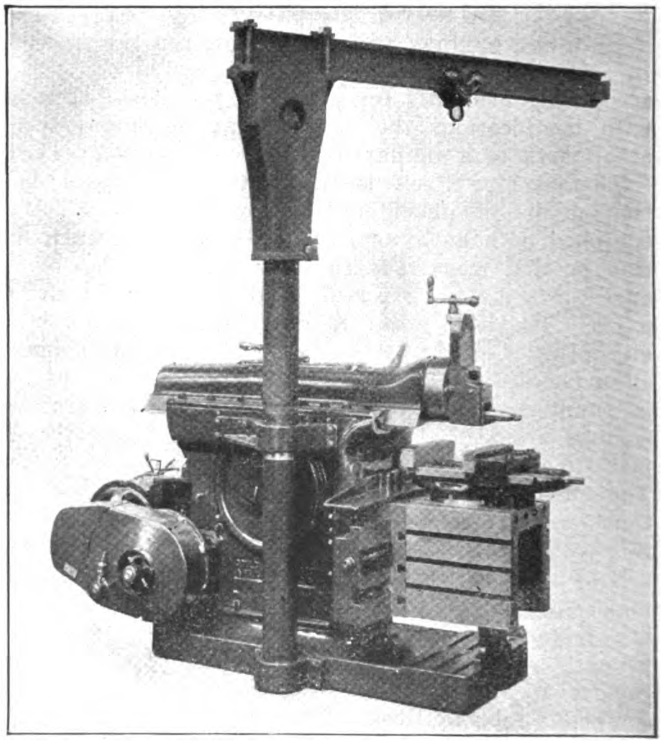
Gould & Eberhardt Jib Crane for Shapers

A jib crane to facilitate the handling of heavy work in and out of the vise of a shaper has recently been developed by Gould & Eberhardt, Newark, N. J. The crane eliminates the use of overhead traveling cranes for this work, and is intended especially for railroad shops, steel mills and industries where heavy work is handled.

As can be seen by the accompanying illustration, the crane is attached to the frame of the shaper in two places, and is located on the side of the machine opposite that on which the operator stands. Since the machine is driven directly by a motor and no belts are in the way, the crane can be revolved completely around. The crane will handle the maximum weight of work that the machine is capable of doing.

The mast is made of heavy wrought-steel pipe and securely clamped to the frame of the machine. The boom is an I-beam of sufficient strength to carry 1,000 lb. at its outer end. A trolley for carrying a chain block or motor hoist runs on the boom. A cap attached to the mast carries a ball and socket type of bearing, on which the cast-steel upper pintle rests. The boom is thus properly aligned at all times, so that it can be swung with but slight side pressure.

The machine itself has all levers within easy reach from the operating position, so that the operator can start and stop the machine and still remain close to the work being done. It has single-pulley drive and a



GOULD & EBERHARDT JIB CRANE ON SHAPER

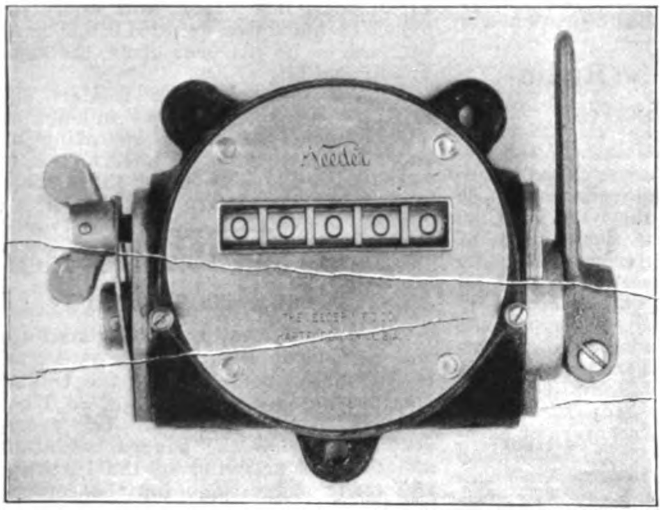
selective-type gear box, with heat-treated steel gears running in oil. Eight changes of speed, ranging from 9 to 115 strokes per minute, are available.

Veeder Heavy-Case Reset Ratchet Counter

The Veeder Manufacturing Co., Hartford, Conn., has recently brought out the stroke counter herewith illustrated, under the name of the Veeder heavy-case reset ratchet counter. The device is especially applicable to heavy presses and other machinery where it is subjected to severe strains from rough usage, vibration or careless handling. The case is extra heavy and the counting mechanism of unusually rugged construction.

The figure wheels are of large size, enabling the dial to be read with ease from a distance of 10 ft. or more. A substantial stop limits the movement of the operating lever to the amount necessary to register on the dial. The lever is adjustable upon the stem and may be set in any desired angular position. A sealing screw of special construction fastens the dial to the case and prevents unauthorized tampering with the reading.

One complete turn (or less, according to the position of the figures) of the wing nut on the side of the case opposite the operating lever immediately returns the reading to zero. The counter is ordinarily provided with a five-figure dial and reset as shown in the illustration, but it can be furnished if desired with a six-figure dial by omitting the resetting feature.

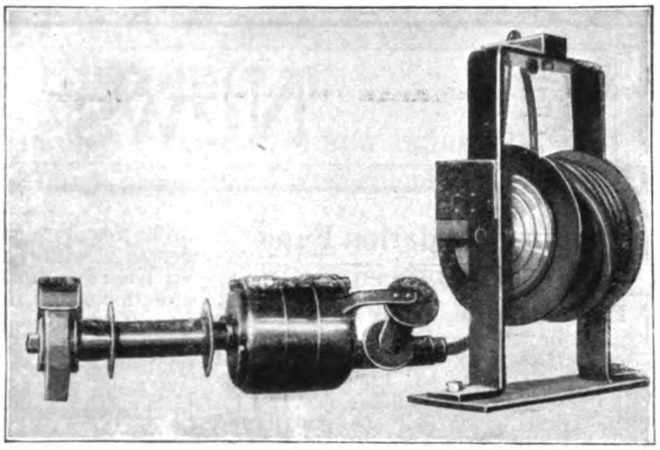


VEEDER HEAVY-CASE RESET COUNTER

Forbes & Myers Reel for Portable Electric Grinder Cord

The accompanying illustration shows a reel that has recently been developed by Forbes & Myers, 172 Union St., Worcester, Mass., for holding the flexible cord that is attached to a portable electric grinder or drill. These tools are ordinarily connected to a light socket by means of a flexible cord which is allowed to drag over the floor as the operator moves from one position to another, so that the cord frequently receives injury from being walked on or catching on sharp projections. Preventing the cable from dragging on the floor greatly increases its life.

In the reel there is a spring strong enough to wind up the cable and keep it off the floor, but not strong enough to annoy the operator as he uses the tool. The reel is adapted to use with different types of portable electric-driven tools, but is regularly furnished as shown herewith with the Model 35 portable electric grinder, together with 35 ft. of flexible cable. With the reel placed centrally in a room, either on the ceiling or on a column, the length of cable is sufficient to reach with the tool practically all positions in a room 60 ft. square.

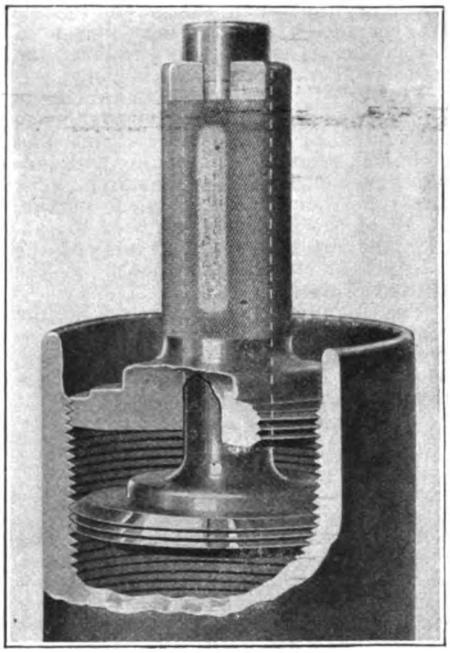


FORBES & MYERS REEL FOR PORTABLE GRINDER CORD

Four wires are incorporated in the cable. Three of them are for the three-phase current which is ordinarily obtained from the lighting circuit. The fourth wire is a ground wire connected to the frame of the grinder and also to the frame of the reel. When the frame of the reel is connected to a water pipe or other permanent ground, danger to the operator from electric shock is minimized.

Pratt & Whitney Double Plug Pipe-Thread Gage

The accompanying illustration shows a gage recently placed on the market by the Pratt & Whitney Co., 111 Broadway, New York, N. Y., for measuring the taper of inside pipe threads. In use, the inner plug is first screwed down into the thread by hand, and is then followed by the outer plug, both parts being set tightly by hand. The witness line on the inner gage should come opposite the zero line on the graduated upper end of the handle. Variation from the true taper can be read directly on the scale. As marked on the handle, each division represents a variation of 0.002 in. in the pitch diameter in a length of 2 in., this length being the distance covered by the gage. The method of marking enables very rapid reading of the error in the taper.



P. & W. DOUBLE PLUG PIPE-THREAD GAGE

News Section

Coffin Foundation Fund Announced

For encouraging and rewarding service in the electrical field, the General Electric Company has set aside a fund of $400,000, to be known as the "Charles A. Coffin Foundation," the income from which will be distributed each year in prizes to its employees, recognition to lighting, power and railway companies for the improvement of service to the public as well as fellowships to graduate students and funds for research work at technical schools and colleges.

The foundation will be controlled and administered by a committee appointed by the board, which will distribute the $20,000 income as follows:

First—Eleven thousand dollars in prizes for the most signal contributions by employees of the General Electric Company toward the increase of its efficiency or progress in the electrical art.

Second—A gold medal, to be known as the "Charles A. Coffin Medal," will be awarded annually to the public utility operating company within the United States which during the year has made the greatest contribution toward the use of electric light and power for the convenience of the public. The company receiving the medal will also receive $1,000.

Third—A similar medal to the electric railway company within the United States which during the year has made the greatest contribution toward increasing the advantages of electric transportation for the convenience of the public. The company receiving the medal will also receive $1,000.

Fourth—Five thousand dollars is to be awarded annually for fellowships to graduates of American colleges and technical schools who, could, with advantage continue their research work either here or abroad, or some portion of all of the fund may be used to further the research work at any of the colleges or technical schools in the United States.

The foundation was created by the company as an expression of appreciation for the work of Charles A. Coffin, who, up to May 16 last, was head of the General Electric Company.

Car Shortage Shows Decrease

A decrease of 16,262 cars in the shortage of freight cars on November 15, compared with that on November 8 was shown in reports received today by the Car Service Division of the American Railway Association from the rail carriers of the country. The demand for cars in excess of the current supply on November 15 amounted to 158,236 cars, compared with 174,498 one week prior to that time.

The shortage in box cars totaled 82,523 on November 15, a decrease of 7,721 within a week, while the shortage in coal cars amounted to 42,827 cars, 2,702 fewer than on November 8. A decrease within the week of 4,130 was reported for stock cars, the total shortage amounting to 15,856. The shortage in refrigerator cars totaled 8,519, a decrease since November 8 of 2,264, while there also was a decrease within the same period of 69 in the shortage in coke cars which brought the total to 270 cars.

Reports filed with the Car Service Division also showed that at the same time there were 4,945 surplus freight cars of all classes and in good order scattered throughout the country on November 15.

Conference on Radio Standardization

The Bureau of Standards of the Department of Commerce has called a conference on radio standardization to be held on Friday, January 12, 1923, in New York City. The desirability of calling a general conference on radio standardization has been apparent in many ways, and this call is issued by the Bureau of Standards at the specific request of the following associations and organizations: Institute of Radio Engineers. National Radio Chamber of Commerce. Radio Apparatus Section, Associated Manufacturers of Electrical Supplies. National Retail and Dry Goods Association. American Radio Relay League. Radio Corporation of America.

The purpose of the conference is to consider broadly (1) whether a formulation of standards for radio apparatus and service shall be made, (2) if so what general classes of apparatus or service should be included, and (3) what procedure shall be recommended for carrying out the conclusions reached by the conference. If the conference decides that radio standards should be formulated, it is expected that they will be prepared with special consideration of the wide range of interests which are concerned with the subject, and that these standards may ultimately be adopted with the approval of the American Engineering Standards Committee as an American Standard.

Southern Iron Industry in Full Swing

The Southern Metal Trades Association advises that practically all furnaces now are operating in the Alabama district, and that a great majorty of furnaces throughout the South now are again in production, with tonnage as a whole for the entire district larger than it has been in almost three years. Extremely large tonnage orders are being received, and pig iron sales over the South are picking up steadily from week to week. Alabama district prices remain practically unchanged, ranging from $27.50 to $28.50. Considerable reductions in stock have been noted the past five or six weeks due to the large demand.

Class 1 Railroads Report Decrease in Earnings

Incomplete reports just filed by the railroads with the Interstate Commerce Commission show that 102 class 1 roads having a total mileage of 137,506 miles, had a net operating income in October of $51,761,300. This compares with $65,543,900 for the same roads in October, last year.

Operating revenues for the 102 roads totaled $332,952,900, an increase of 1.8 per cent above those for the same roads in October, last year, while operating expenses amounted to $261,070,300, an increase of 7.6 per cent above the same month in 1921.

Fifty-three roads in the Eastern district, representing a total mileage of 46,362 miles, had a net operating income in October of $23,579,900, compared with $30,565,500 for those roads in October last year.

Weights and Measures Men Meet December 8

The annual meeting of the institute will be held on Dec. 8, 1922, at 2 p.m. in Assembly Room No. 3 of the United Engineering Society Building, 29 West 39th St., New York City. The president will review the general situation affecting the activities of the Institute and make suggestions for the coming year.

A special feature of the occasion will be an address by A. G. Christie, professor of mechanical engineering, Johns Hopkins University.

New Locomotive Works for Poland

According to a report received from Poland, H. Cegielski of Posen, proprietor of extensive machinery works at that place, will start the erection of a third Polish locomotive manufacturing plant in the early part of next year. Largely interested in this new works is the well-known Belgian firm of Cockerill at Seraing in Belgium. Meantime the Polish Railway administration has placed an order for 100 locomotives with the above named Cockerill works, these engines to be delivered in the course of the year 1923. The construction of quite a number of important engineering plants is under consideration, Poland thus offering quite a market for machinery and tools.

First Radio Exposition

The first American radio exposition will be held in Grand Central Palace December 21 to 30. To date fifty manufacturers making radio apparatus have contracted for space, and these include the most important firms in the country. Added to what these makers will have to contribute, there will be various features from other sources to make the exposition a most interesting one.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

ABOUT 60 years ago in an essay upon the United States, the great English economist, John Stuart Mill, said in effect that "the American people when confronted by a grave economic question have often seemed upon the point of answering it wrongly but their common sense has in the end prevailed and they have *acted* wisely."

The history of the United States since Mill made this observation has justified his confidence in the ultimate economic sanity of the people. The greenback movement, the free silver movement and various other economic heresies that have from time to time been popular have each died a natural death when it came to a final show down, and there seems to be every probability that the ghosts of radicalism by which the stock market has been so much scared since the election will soon be dissipated as by discussion the sunshine of common sense and intelligent self interest is directed upon them.

This at least seems to be the sober second thought of the American financial world and as a result the security markets have been stronger and their tone at the end of the week was distinctly better. There is no reason why a sound investment security should not be worth as much now as when it was selling 10 points higher. The value of the property which it represents is in most cases greater. The prices of commodities have not wavered, reports from industries and corporations have continued favorable, dividends in some cases have been increased and in others resumed after long lapses, and prosperity is widely advertised by the continuing distribution of corporation surpluses in the form of stock dividends. There is no doubt that an autumn trade of impressive volume is being carried on at reasonably profitable prices.

Money is, moreover, slightly easier and business men are mostly optimistic. These facts have been obscured by the political clouds coming out of the West, but they are becoming manifest to all who realize that few radicals live up to their promise once they get to Washington, and the indications seem to favor a gradual recovery in the stock and bond markets as investors regain confidence and commence to look for bargains.

The seasonal demand for money has apparently passed its peak. Interruptions in the heretofore continuous increase in the bill holdings of the Federal Reserve System have been reported and commercial loans of member banks have been declining fitfully since the middle of October. Our banking resources are so far in excess of the needs of commerce that interest rates are likely to decline again and surplus banking funds, as in the past, are likely to find their way into good securities which yield more than the going rate for money.

In the commodity markets no sensational movement of prices has taken place. Sugar advanced quite sharply. The Cuban stocks of old crop sugar are now completely exhausted but the new crop will be soon available and it is possible that its impact will cause a temporary decline.

Rubber is up to 27 cents as the prospect of co-operation in the control and limitation of supply becomes more definite. Cotton is quiet as the market waits for the Government estimate due December 12th, but the figures, whatever they may be, will not change the facts of supply and demand, which seem fairly equated at the current price level.

Hides have reacted slightly after a prolonged advance, but wool has been climbing higher almost every day for many months and no one in the trade seems to expect an early decline. The much discussed lagging of prices of agricultural products, which is held up as the chief obstacle to trade expansion, does not greatly affect cotton or wool, and the advances in grain and livestock have narrowed the price spread between the various groups of commodities more than has possibly been realized. As long as there is no unemployment and wages continue high further declines in commodities are not to be expected, and if the efficiency enforced by competition keeps down the costs of distribution and merchants do not unwisely force up prices by endeavoring to recoup all their inventory losses in this one season continued good trade seems to be assured.

Railroad earnings for October were somewhat disappointing. The failure of the roads to keep pace with the transportation needs of the country is clearly shown in recent figures of car loadings. Though more freight has been offered than at any time in the history of the country the roads have at no time succeeded in carrying as much as they did in the fall of 1920, and traffic congestion has increased the burden business has had to carry.

The intention of the Farm Bloc to force the much needed reduction in freight rates is therefore announced at an unfortunate time, for public opinion will favor some constructive action looking toward cheaper and more efficient transportation rather than arbitrary rate slashing, and in such action the compulsory consolidations contemplated by the law will occupy first place. These consolidations are therefore likely to become important stock market influences as time goes on. All industries are caught in more or less degree between the mill stones of high labor and material costs and the natural resistance of higher prices, and many of them are taking the merger route to effect savings in production and gain greater competitive power. The absorption by Bethlehem Steel of Midvale and Cambria,—providing the Federal Trade commission does not interfere—and the contemplated packers' merger are cases in point. Nor do I think the tendency should be discouraged. From big and open consolidations the public has much to gain and nothing to fear, because they can be quickly destroyed when they become oppressive.

The ship subsidy has passed the House, but it has been vitiated by the amendment which practically compels its renewal every year by Congress and there is small chance that it will pass the Senate. It will not be as much of a loss as believed by its supporters, who have been viewing its defeat through rose-colored glasses, and with the Government's income dropping off steadily its defeat will be a relief to tax payers.

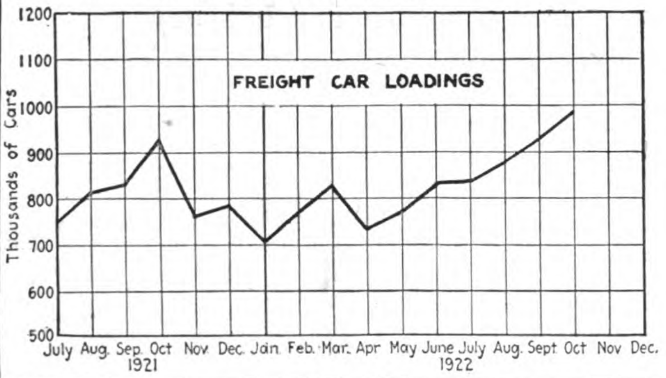
From abroad there was little significant news during the week, though the experiment of the Greeks in executing a few of the leaders who guided them to military disaster must be set down as worth attention and some may consider it a progressive step. The volume of German paper money is increasing so fast that the process threatens to become multiplication instead of addition, and it is only a question of time before the worthless mark is replaced by foreign currency. The reflections of Germany's weakness are apparent in the unsteady undertone of the foreign exchange markets, where further declines, except in sterling, are rather widely expected, and in the virtual cessation of the flotation of foreign loans in this country.

Postal Receipts Show Business Recovery

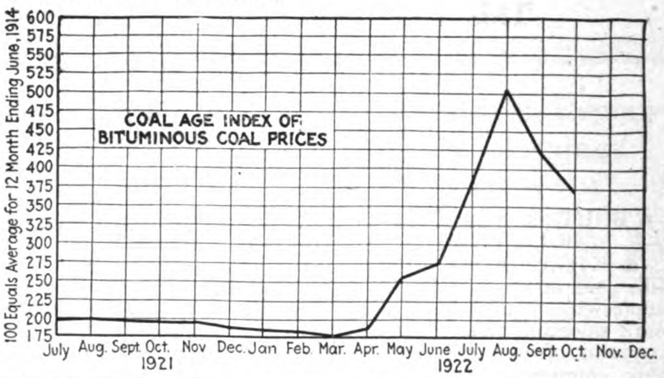
Present business recovery is reflected in United States postal receipts according to the National Bank of Commerce in New York. A review of these receipts for the past three years shows, furthermore, that they provide an index of both seasonal and cyclical variations in commercial activities.

"Reports from fifty representative cities throughout the country, covering the period from January 1920 to October 1922, evidence striking similarity in general seasonal trend," says the December number of the bank's magazine, *Commerce Monthly*. "Receipts are high in the early months of each year, reflecting spring trade. They decline with midsummer dullness and rise again with the coming of fall trade. They reach their peak with the arrival of Christmas activities.

Weekly car loadings of revenue freight based on reports from the railroads of the U. S. by the Car Service Division of the American Railways Association.



Coal Age Index of Bituminous Coal Prices, f.o.b. mines, the average of spot prices from July, 1913, to June, 1914, being taken as the base.



FREIGHT car loadings mounted up rapidly during October with an average weekly loading of 992,219 cars for the month as compared with 936,386 in September. Beginning with 968,169 cars loaded for the week ending Oct. 7, there was a rapid increase each week, the loadings reaching 1,014,480 cars for the seven-day period ending Oct. 28, the highest point attained since 1920. Heavy loadings of coal, grain and merchandise were the features of the movement, only the serious car shortage preventing, doubtless, the highest loading mark ever recorded in American railroad history.

Automobile production for October recovered much of the ground lost during September, a total of 217,098 cars and 21,416 trucks being produced as against 187,128 and 18,656 respectively. As compared with October, 1921, there was an increase of 82,864 in cars and 8,603 trucks produced. The October production brings the total car output for the ten months of 1922 up to 1,913,439 and the truck output up to 200,302. The re-opening of the Ford factories and an adjustment of the coal situation were factors largely responsible for the increase over September. Production schedules for November indicate an output close to that of October.

Bituminous coal prices, as indicated by *Coal Age* index, continued their downward movement during October from the high point reached in August. The index for October was 370 as against 412 in the month previous, the spot prices for the same periods standing at $4.48 and $5.08 respectively. Continued mild weather during the month, a shortage of cars and a lack of demand for steam coal have been contributing factors in causing the price decline.

Comparative Prices of Shop Supplies

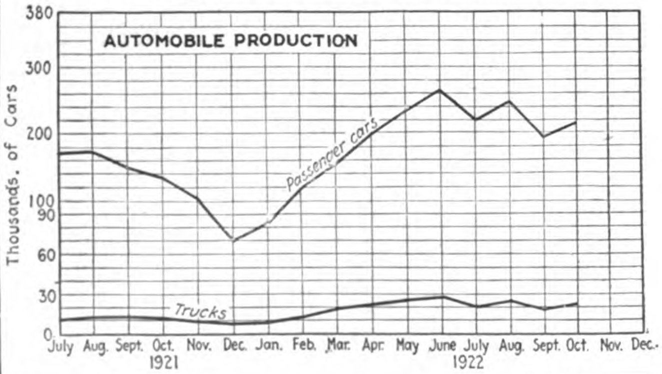
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb.	$0.0295	$0.0295	$0.0273
Cold finished shafting......	per lb.	0.0378	0.0378	0.0373
Brass rods.....	per lb.	0.171	0.1700	0.15
Solder (½ and ½)	per lb.	0.24	0.23	0.20
Cotton waste..	per lb.	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100	3.11	3.11	....
Lard cutting oil	per gal.	0.59	0.575	....
Machine oil....	per gal.	0.36	0.36	....
Belting, leather, medium......	off list	30–10% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list	55% @60%	50%@ 65–10%	50%@ 60–10%

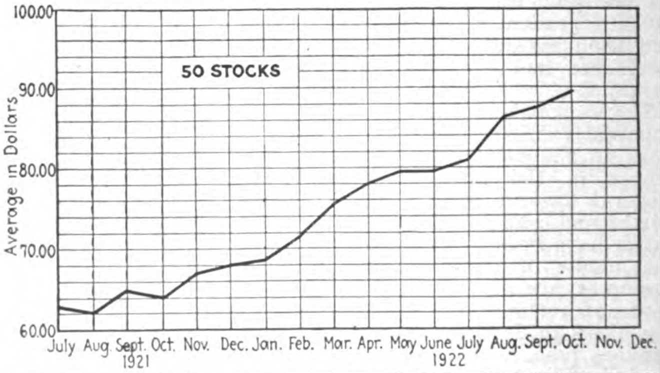
Share markets in New York, as reflected by daily compilations made by New York *Times Annalist*, show a continuance of the upward movement during the month, the average price of 50 stocks, 25 rails and 25 industrials, reaching $89.88 as against the September average of $87.85. The high point during the month was reached on Oct. 21 with an average of $91.32 from which mark prices declined to an average of $88.37 on Oct. 28. Industrial stocks continue to lead the upward movement, more particularly the railway equipment issues, all of which have booked a large volume of business.

Skilled metal workers are scarce and rates are high. In the New York district tool makers are being paid 75, bench hands and lathe hands 60 cents per hour. Philadelphia reports a range of rates which is wider and somewhat higher, toolmakers receiving from 60 to 90, bench hands 50 to 85 and lathe operators 50 to 90. The Detroit district range for toolmakers is between 75 and 80, bench hands 50 to 55 and lathe operators 70 to 75 cents per hour. Cleveland reports show toolmakers' rates ranging between 50 and 75, bench hands between 40 and 60 and lathe operators between 35 and 65.

Passenger cars and trucks, production based on figures compiled by the Bureau of Foreign and Domestic Commerce. Average for 1919, 138,138 cars; 26,364 trucks.



New York Times Annalist combined average price of 25 railroad and 25 industrial stocks based on weekly averages of last sale in each week.



Business Conditions in England

General Outlook Brighter—Collapse of Germany and Taxation Retards Recovery—Machinery Industry Slightly Improved

By OUR LONDON CORRESPONDENT

DURING the last few weeks, industrial affairs have been pushed aside in Great Britain by electioneering, and "the revolt of the under-secretaries" has brought about a position in which, as is usual, political affairs have been held of greater importance than more direct efforts to improve the economic position. It is, however, at last quite generally recognized that trade cannot be talked up and anyone who expresses the opinion that conditions are improving is usually now ready to put but a modest estimate on the immediate value of that improvement. We are learning very frequently and quite effectively that we are over-burdened with taxation, and that until this load is lifted real improvement cannot be expected. Colonel O. C. Armstrong, until recently the president of the Federation of British Industries, has expressed the opinion that the outlook is rather brighter than it has been during the past 18 months, but he went no further than to suggest that there are slight signs of revival in a certain number of industries. Few will assert that engineering and shipbuilding are among these; in fact it is sections of the textile trades and the coal trade that offer the most encouragement to optimism.

Effect of the German Collapse

We are now as a body perceiving what the collapse of Germany must mean, and have recently been told that, with Russia out of the market and Germany and Austria in the same position, we have lost some 12 per cent of our total export trade as done in the year before the war. It will be obvious therefore that even with the same population and the same standard of living it is necessary for us to find markets equivalent to those mentioned, and the suggestion is that, to effect the compensation, we should look to South America and the Far East. The latter area has in fact sent a number of enquiries of late, particularly for metal products. It has been urged that the British Colonies might take the place of the lost markets. But they have always been good customers, and their purchasing power for British goods, considering the unit of population, is much higher than that of our European markets. At the same time the total population, and therefore the total potential demand, is by no means comparable, and if Canada, Australia, New Zealand, and British South Africa are all regarded as a single market the population concerned is not equivalent to more than say three Londons.

Our figures relating to unemployment have been somewhat variable of late, but, after a setback of a few weeks, improvement is again being reported. Any movement of wages rates is nearly always a decline and so far during the year the official reports indicate a net reduction approaching four million pounds in the weekly wages of about seven and a half million people, any increases being almost negligible. The general percentage of unemployed trade unionists is more than 14½, the percentage of unemployed workpeople insured under the State scheme being nearly twelve. Although these figures indicate a condition which is bad enough, engineering as a whole is in worse case. According to a recent report of the Amalgamated Engineering Union, nearly 80,000 were unemployed or close on 25 per cent of the membership. Since the Armistice a sum of 281¼ million pounds has been expended officially on unemployment relief, one way and another. Even the undertakers are complaining: one such person included in the reasons for his business failure "bad trade caused by the prolonged low death rate."

Improvement in Steel Market

The latest report of the London iron and steel market suggests a slight improvement, with, to take one item, brisk business in the sheet steel market; but as regards stainless steels, while their applications are being extended attempts towards an increased rate of production are hampered by difficulty in obtaining greater supplies of chromium. Some of the home railways have been ordering rails and rolling stock. Also it is reported that orders are being placed for wagons by private traders for the first time since the de-control of the railways. In shipbuilding there has been some slight improvement and the practically depleted slipways, etc., of Vickers, Ltd., Barrow, will soon be partly occupied in the production of a 20,000-ton passenger liner for the Orient Company, with oil-fuel boilers and turbines driving through single-reduction gearing. Some measure of revival is expected in shipbuilding generally, as soon as wages have been re-adjusted. The Armstrong-Whitworth combination have obtained a contract for a floating dock at Southampton, the largest ever projected; its length will be nearly 1,000 ft., so that it will readily accommodate the "Majestic," which is 912 ft. long with a gross tonnage of 56,000. More than 20,000 tons of steel will be required and the work will occupy about eight or nine months. The dock is being constructed at the firm's shipyard at High Walker on the Tyne. Their old shipyard at Elswick is now occupied mainly by the locomotive works and pneumatic tool, small oil engine and other factories.

Boiler Makers Show Prosperity

In common with some other firms, Armstrong-Whitworth have secured orders for locomotives for India. The locomotive industry is not particularly flourishing, and in order to secure orders some very low prices have been quoted; in fact one firm has decided not to quote again until their competitors have sufficient work in the shop to prevent this practice of cutting. Whatever may be the case with other boiler-makers, Babcock & Wilcox, Ltd., continue prosperous, and have apparently placed their dividend on a regular 16 per cent basis, the reserve amounting to nearly two million pounds. Getting down to smaller items, for some reason or other, ball-bearing firms have been doing better of late.

Developments in air travel may be recorded, viz., the opening of the line from Manchester through Croydon, near London, to Rotterdam and Amsterdam, the journey occupying about four and a half hours. Extensions through Hamburg to Berlin are in contemplation, thus doubling the time of the journey.

How our automobile industry is handicapped by taxation, as compared with your own, was mentioned in the course of the annual dinner of the Society of Motor Manufacturers and Traders, when it was stated that per vehicle the average taxation on your side is £2, 8s. whereas on this side it works out at about £18, 17s. per annum. The society, by the way, will be exhibiting at the British Empire Exhibition of 1924, and a marine motor exhibition which will be held in 1923. The fortunes of the automobile industry have usually been thought to depend markedly on the result of the London Show; but some of its participants are becoming vocal on its excessive cost. According to a recent estimate our automobile production capacity is four times the home absorption capacity—hence the need for exports in this line.

Of the machine tool industry it will be sufficient to mention that some of the locomotive building firms have made extended trials with the oxy-acetylene cutting process for shaping frame plates on machines of planer type. A Gateshead maker of grinding machines has recently, by means of segmental blocks, removed by surface grinding 23 cubic inches of cast iron per minute and even more.

Westinghouse Ships Big Order to Chile

The third shipment of electrical equipment for the Chilean State Railway, consisting of six complete electric locomotives, the largest shipment of electric locomotives ever made, recently left the East Pittsburgh Works of the Westinghouse Electric and Manufacturing Co. The shipment was valued at $700,000 and represented a partial fulfillment of the $7,000,000 contract awarded the Westinghouse International Co. by the Chilean State Railways.

Thirty-nine electric locomotives, 15 for road freight service, six for express passenger service, 11 for local passenger service and seven for switching service, are to be built by the Westinghouse Co. for the Chilean Railways. The six locomotives in the recent shipments are of the road freight type and weigh approximately 103 metric tons each. They are capable of maintaining an average speed of 35 miles per hour when hauling a 770 ton train on any part of the line between Valparaiso and Santiago, except the Tabon grade.

Washington Notes

By Paul Wooton

The Supreme Court has denied a motion for a writ of certiorari sought by Clarence E. Reed and the Reed Roller-Bit Company to review the decision by which the lower courts held for the Hughes Tool Company in the latter's claim that a patent was valid for an hydraulic force-feed lubricator employed with a rotary roller, oil-well drill-bit.

The Supreme Court has denied a writ of certiorari sought by the Pyle-National Company to appeal from the decision of the lower court dismissing its suit against the Oliver Electric Manufacturing Company alleging patent infringement of parts adapted for use in the Pyle locomotive headlight. The denial was on the ground that the petition was filed too late. The lower courts held that there was no infringement as the use of the parts from the Oliver company came within the repairs classification and that the headlight as a system was not duplicated. The Pyle-National Company had contended that only parts made by it were suitable for replacements.

The wage board at the Washington Navy Yard is understood to have recommended a reduction of one cent an hour in the pay of machinists. Under the present scale machinists are receiving 73 cents an hour. This reported action has brought forth a storm of protest from the machinists who are employed at the Navy Yard who contend that the board, under the law, must recommend an increase to 87.5 cents per hour, which they say is the rate of pay in private industry in the Washington region.

Legal Penalties Not Included in National Safety Codes

Clauses relating to legal penalties or to methods of enforcement will not be included in the safety codes approved by the American Engineering Standards Committee. This policy was established at a meeting of the A. E. S. C. in New York on Oct. 20.

This action was taken on the suggestion of the Safety Code Correlating Committee, which acts in an advisory capacity to the American Engineering Standards Committee.

It is the feeling both of the men engaged in the furtherance of standardization in industry and of practically all state officials that legal penalties for failure to conform with established state safety codes and methods of enforcement can best be decided by each state for itself.

Swedish Railways Try Motor Cars

Early in November the Swedish State Railways received the first three motor cars from a German firm at Kiel, to be tried on several sections of the railroad. These benzine motor cars are built of steel, having at each end a driver's stand, and capable of lodging 75 passengers. A benzine motor of 160 hp. acts as propelling power and the greatest speed is 80 kilometers per hour.

Novel Clock Tells Daily State of Your Business

Included among twenty-five forms presented in a treatise on budgeting as a means of business control, issued by the Fabricated Production Department of the Chamber of Commerce of the United States, is a novel clock arrangement by which the small manufacturer can tell at a glance the daily state of his business.

Clocks, or dials, are devised for each of the principal activities of the business. Each clock has two hands, a red one, pointed at the budget allowance, which remains stationary for the entire month, and a black hand, which is daily set at the amount of money spent by each department. The dials can be arranged so that they can be conveniently contained in a flat box 2 in. deep, 24 in. wide and 50 in. long, designed for hanging on the wall.

The idea was conceived and put into operation by a manufacturer of optical goods, who found that his organization could be conveniently divided into the following five groups: Material, Factory, Administration, Sales and Advertising. The five executives at the head of these departments are placed into a business of their own and are told what the results of their month's activities should be, together with the amount of money they may spend to produce these results. The Sales Manager is told how much in orders he is expected to get to keep the factory running; the Factory Superintendent, how much goods he must get out and how much accounts receivable he must create to provide the funds necessary in the following month; the Purchasing Agent, how much material is necessary to keep a well balanced inventory and to take care of the plans of the Sales Department; the Advertising Department and Administration, how much money they may spend in carrying out these plans.

A copy of the pamphlet "Budgeting for Business Control" may be secured by writing direct to the Fabricated Production Department, Chamber of Commerce of the United States, Washington.

Manufacture of Steam and Electric Railroad Cars: 1921

The Department of Commerce announces that the census reports show a decrease in activities of establishments engaged in the manufacture of cars for use on steam and electric railroads during 1921, as compared with the year 1919.

In 1921 there were 105 establishments engaged in the manufacture of steam-railroad cars and the total value of their products amounted to $314,394,867, as compared with 99 establishments for 1919 with a total value of products of $538,222,831. The decrease in the total value of products was $223,827,964, or 41.6 per cent.

During this same period there were 10 establishments engaged in the manufacture of electric-railroad cars and the total value of their products was $14,856,068 as compared with 7 establishments for 1919 with a total value of products of $18,441,976.

Iron and Steel Markets in September

Canada was the largest purchaser of American iron and steel during September, according to the Iron and Steel Division of the Department of Commerce, taking 41,417 tons. Japan held second place with 22,328 tons. The shipmnets to other important markets were: Cuba, 7,656 tons; Mexico, 6,193; Brazil, 6,133; China, 5,689; United Kingdom, 4,306; Chile, 4,229; Argentina, 4,145; Chosen, 3,403; India, 2,909; Australia, 2,403; Colombia, 2,303; Philippine Islands, 2,224; Peru, 1,562; Rumania, 1,463; Venezuela, 1,304; Hongkong, 1,074; British South Africa, 979; and Panama, 978 tons.

The decline in total iron and steel exports which began in June continued through September. The total for the month amounted to 130,728 long tons, only 57 per cent of the exportation during May, which is the record month of the year, and a drop of 11 per cent from the August figure.

Total exports for the first 9 months of 1922 were 1,597,204 long tons, composed principally of steel rails, black steel sheets, iron and steel bars, and rods other than wire, and boiler tubes.

Further Decline in Structural Sales

A marked seasonal decline in the sales of fabricated structural steel in October is announced by the Department of Commerce from reports made to the Bureau of the Census. October sales amounted to 54.9 per cent of shop capacity, compared with 61.6 per cent in September.

Reports received from 140 identical firms from April through October, with a shop capacity of 221,790 tons per month, show the following actual tonnages booked each month and the percentage of shop capacity represented by these bookings. A revision of these capacities in accordance with a uniform standard is now being undertaken by the Bureau of the Census but the results are not yet complete.

	Tonnage Booked	Per Cent of Capacity
April	191,05	86.5
May	172,260	77.7
June	153,278	69.1
July	141,907	64.0
August	143,515	64.7
September	136,587	61.6
October	121,763	54.9

Austro-Russian Industrial Syndicate Formed

A number of well known Austrian machinery companies, including the Linz Locomotive Works of Linz, the Austrian Arms Factories of Steyr, Ltd., of Steyr, and Brevillier & Urban have formed a syndicate with several Russian firms for the purpose of marketing the Austrian product in Russia as well as to establish new factories in Russia. All kinds of machinery and tools will be made and sold, and special interest will be paid to agricultural machinery for which there exists a tremendous demand all over Russia, and especially in the Ukraine and the Caucasus. It will be well remembered that these districts were formerly very extensively supplied by American manufacturers.

Market for Machine Tools in Dutch East Indies

The markets in the Netherlands East Indies in 1921, says the Bureau of Foreign and Domestic Commerce, absorbed more than four times as much machinery as in 1911. During that period the share of this business secured by American manufacturers has expanded nearly 22 times, namely, from 264,000 guilders to 5,701,000 guilders (1 guilder=$0.402).

The following table is given from the statistics published by the government of the Netherlands East Indies, giving the returns for 1920 and 1921, and shows the machine tools and other machinery imported into the archipelago, as well as the principal countries of origin and the extent of the participation of each:

IMPORTS OF MACHINE TOOLS IN 1920 AND 1921

		Machine Tools	
		Value in Guilders	Per Cent of Total
United States	1920	865,165	6.7
United States	1921	890,370	19.4
Great Britain	1920	947,298	7.3
Great Britain	1921	517,441	11.3
Netherlands	1920	3,301,131	25.4
Netherlands	1921	2,279,957	49.7
Germany	1920	448,489	3.8
Germany	1921	740,958	16.2

IMPORTS OF OTHER MACHINERY AND TOOLS IN 1920 AND 1921

		Other Machinery and Tools	
		Value in Guilders	Per Cent of Total
United States	1920	3,908,266	25.7
United States	1921	2,372,946	12.7
Great Britain	1920	2,047,808	13.5
Great Britain	1921	2,521,888	13.5
Netherlands	1920	7,390,396	48.6
Netherlands	1921	10,145,387	54.5
Germany	1920	1,086,485	6.9
Germany	1921	2,634,318	14.1

American participation in the machinery trade of this archipelago is really much greater than the above figures would indicate, because the customs returns makes no allowance for trans-shipment cargo, and German, British, and American machinery shipped by way of the Netherlands would be credited to the latter country. Vast quantities of machinery are so shipped.

The sales problem for this territory, therefore, is complicated by the fact that large quantities of machinery for use in this archipelago are purchased in the Netherlands. Ordinarily it will be found necessary to arrange for sales effort in both the Netherlands East Indies and the Netherlands if a consistent program is to be developed for covering this territory. The Bureau of Foreign and Domestic Commerce can supply information regarding machinery dealers covering this territory.

The market in the Netherlands Indies is a very attractive field for sales effort for a number of reasons. In contrast with conditions in Europe, the exchange ratio is not very unfavorable and the fluctuations in exchange have settled down to narrow limits. Business is practically stabilized, and it would appear that these markets have escaped from the worst of the influences resulting from the war.

This territory is a very large one, extending a greater distance from east to west than the width of the United States and from north to south a distance comparing to that from Canada to the Mexican border.

Japan Importing Heavily from Germany

Japanese imports from Germany have been increasing and are now greater in volume than before the war, according to Japanese periodicals received by the Department of Commerce. For the year ended May, 1922, these imports amounted to 83,310,000 yen (1 yen equals $0.4985), an increase of 22,150,000 yen over the 1913 imports.

The amount of imports from Germany for the first five months of this year exceeded by some 35,000,000 yen that for the first five months of last year, and it is generally believed that this year's total will be over 100,000,000 yen, if the same rate of increase is maintained until the end of the year.

Bulgarian Imports of Steel and Machinery

The Bulgarian Government has just published the statistical returns for the year 1921, according to which the country imported 185,785,000 Lewa worth of machinery and 351,784,000 Lewa worth of iron, steel and manufactures thereof. The machinery imports consisted chiefly of agricultural machines and implements, all kinds of industrial machinery, machine tools and saw-mill machinery.

Compiles Five Foot Book-Shelf of Foreign Trade

The completion of a Selected Bibliography of Foreign Trade, 1922, in which are listed the leading authorities on various aspects of International Commerce, is announced by the National Foreign Trade Council, of India House, Hanover Square, New York, from whom copies can be obtained.

This Five Foot Book-shelf of Foreign Trade contains fifty titles dealing with training for foreign trade, the history and geography of foreign trade, the practical administration of an export business, and with all phases of ocean transportation.

Advice on Export Problems Offered by Experts

The organization of a Trade Adviser Service to act throughout the year as a medium for the interchange of experience on foreign trade problems, was announced today by the National Foreign Trade Council, India House, New York.

"This service," says O. K. Davis, secretary of the Council, "is intended to provide foreign traders with a confidential answer to those intimate, personal, or unusual problems which cannot be handled in a satisfactory manner through existing Governmental or private agencies. It will be of very practical assistance to foreign traders in improving the technique of export organization, sales methods, foreign advertising, commercial credits, traffic management and similar matters.

The general chairman of the Trade Adviser Service is E. P. Thomas, President, U. S. Steel Products Co.; A. E. Ashburner, American Multigraph Sales Co., is vice-chairman; and C. J. Warren, Remington Typewriter Co., is executive chairman.

Big Italian Steel Works Reorganized

Reorganization of the Ansaldo Steel Works is being effected by the formation of a new company, bearing the same name, having a capital of 200,000,000 lire divided into 1,000,000 shares of 200 lire, says Consul Leon Dominion, Rome, in a report to the Department of Commerce. According to press notices, the Banca Nazionale di Credito has subscribed for 1,250 shares, and the Gio, Ansaldo Co. for 998,750 shares. The new company has taken over the principal plants of its predecessor, among which are the Sampierdarena machine shops and locomotive works, Sestri Ponente dockyards, Borzon yards, Fegiano railroad car works, Campi cannon foundry, Delta steel works at Cornigliano Ligure, Campi electrical works, Multedo iron foundry, Cornigliano steel works and bronze and aluminum plants.

The purchase price of these establishments is stated to be 28,405,800 lire, and payment has been made to the old Ansaldo Co. by means of 142,029 shares of the new company. The new company furthermore assumes liabilities amounting to 40,261,339 lire on bonds issued for the account of the plants it has taken over and which are guaranteed by mortgages.

About 45,000,000 lire in bonds remains in the hands of the old company, which also retains its ownership in the Cogne mines, Aosta hydro-electric plants, Murlo lignite mines near Siena, Pa manganese mines near Sassari, Lauriano Po cement and lime factory near Turin, automobile factory at Turin, and dockyards at Voltri.

Commercial Travelers' Guide to South America

The new revised edition of the "Commercial Travelers' Guide to Latin America" has just been released by the Department of Commerce. It is an encyclopedia of the countries south of the United States. It is the only complete and up-to-date "Baedeker" for the traveler. Everything that a foreign representative should know is included within its 698 pages; salesmen's equipment, steamship routes and railroads, connections and rates, schedules of sailings, postal and cable services and rates, hotel accommodations in the various cities, restrictions on travelers, duties on samples and advertising matter.

Whether you may wish to reach Bogota or Barinas the little volume will tell you how to get there. Every Latin-American market is listed and described, and every city of any importance is fully covered. It contains suggestions and advice as to the best time of the year to visit certain countries, the best methods to be employed in covering a territory or approaching a prospective field. It is replete in sound advice to the uninitiated and helpful hints to the experienced traveler. This work is the result of years of careful tabulation, research, and first-hand study by Mr. Filsinger, assisted by a corps of experts of the Department of Commerce in Washington. The price is $1.25 prepaid and may be secured by application to the Superintendent of Documents, Government Printing Office, Washington, D. C.

Immigration Policy To Be Taken Up by Congress

With one bill already being whipped into shape, and a marked revival of interest by organizations concerned in the subject, it is probable that the question of a permanent immigration policy will occupy much more attention at the winter session of Congress than had been anticipated last summer when the temporary 3-per cent quota law was extended for two years.

The only concrete proposal that has made its entrance into general capitol comment thus far, and which it is understood is being drafted into a bill, is to replace the 3 per cent law with one permitting annual admission of quotas equal to 2 per cent of the foreign born residents of the United States according to the sensus of 1910, divided by nativity, and with the stipulation that an entire family of immigrants, regardless of its number, shall be considered as a unit. This stipulation naturally would increase the number admitted above the actual 2 per cent. Experts are studying immigration reports to determine just what effect this would have on the actual inflow.

The general sentiment of congress, however, appears to favor some form of selective immigration, coupled with a maximum limitation feature. There has been no definite centralization of ideas on this point, however.

It had been expected that determination of a permanent immigration policy would be left for the Sixty-eighth Congress, inasmuch as the temporary law now runs until June 30, 1924, but the subject is being agitated to such degree that action may be taken by the present Congress before it expires.

Business Items

The New Process Gear Co., Syracuse, N. Y., has sold the entire issue of $2,000,000 first mortgage 6½ per cent bonds to S. W. Strauss & Co., New York City.

The Stanley Rule and Level Co., New Britain, Conn., has begun work on a 60-foot addition to its forging department on Summer St., Southington, Conn.

The American Can Co. declared a dividend of 1¼ per cent on the common stock. This is the first dividend on the junior issue since the company was organized in 1901. The dividend is payable Feb. 15 to stockholders of record Jan. 31. The regular dividend was also declared on the preferred stock.

The Charles E. McGill Machine Co., recently organized in Binghamton, N. Y., by Charles E. McGill, for several years president of the McGill & Holford Co. of that city, have started operations on Commercial Ave., where they will produce their line of textile machinery. Plans have been made for a modern factory to be erected during the coming year.

The Studebaker Corporation, in its report for the third quarter, shows a total production of 87,951 cars as against 56,163 in 1921. The total production for 1922 is expected to be about 110,000.

The Imperial Electric Co., Akron, Ohio, has completed a new foundry, and outside work in brass castings will be taken on, officials of the company announced last week. The new plant is the only oil burning foundry in Akron. Samuel B. Myers, formerly of Dayton, is now identified with the plant, having been connected with the Utah Copper Co. before going to Dayton.

The Langhaar Ball Bearing Co., Aurora, Ind., is now building a new factory and remodeling an additional shop adjoining the structure, the company's business having outgrown the present capacity.

The American Screw Co. directors have voted a fifty per cent stock dividend and have called a meeting of stockholders for Dec. 1 to approve the action. The company has now $3,000,000 stock outstanding and at the end of 1921 its surplus was $2,962,372.

The Waterbury Rolling Mills, Inc., makers of brass, bronze and nickel silver sheets, of Waterbury, Conn., has recently increased their capital stock from $200,000, to $600,000.

The Branford Brass Foundry Co., Inc., of Branford, Conn., incorporated a few weeks ago to engage in the brass foundry business, organized the past week by the election of the following officers: Hugh A. Cox, president; Frederick A. Ells, secretary; and Robert L. Rosenthal, treasurer.

The American Pin Co., manufacturer of brass goods, pins, etc., of Waterbury, Conn., has recently increased its capital stock from $600,000 to $1,500,000.

The Stanley Works, New Britain, Conn., manufacturers of rules, levels, etc., has recently purchased property on Elm Street, their city, from the New Britain Machine Co., and the Damon Coal Co. The property will be utilized for their own operations.

The Manufacturers' Association of Bridgeport, Conn., held their annual meeting during the past week, and elected the following officers for the ensuing year: George M. Eames, of the Singer Manufacturing Co., president; Summer Simpson, president of the Raybestos Co., first vice-president; T. Rice Davis, second vice-president; and R. G. Farrell, treasurer.

The Western Iron Stores Company, Milwaukee, Wis., John A. Camm, president, held a house-warming in its newly organized and arranged store, on Saturday, Nov. 25.

The Alexander Millburn Co., Baltimore, Md., has been appointed exclusive representative of the Wilson Welder and Metals Co., 132 King St., New York City, for its products in Maryland, Virginia and the District of Columbia. The company will carry in Baltimore a large stock of color-tint welding metals and plastic arc welding machines for distribution in that territory.

The Ford Motor Co. of Canada, according to reports, will let a contract in the near future for a new factory at Ford, Ontario, with a floor space of approximately 625,000 square feet and of one story steel construction. One of the features of the new structure will be the application of direct motor drive throughout instead of overhead transmission. It is expected that the new plant will be in operation by May or June of next year.

Personals

Charles S. Cole, president of the Premier Manufacturing Co., novelty manufacturers, etc., Sandy Hook, Conn., has recently been made president and a director of the W. & B. Douglas Co., manufacturers of pumps, of Middletown. Conn.

DALE D. BUTLER, secretary of the W. & B. Douglas Co., manufacturer of pumps, etc., Middletown, Conn., has recently been elected president of the Middletown Chamber of Commerce.

MARSHALL CUTTING, formerly with the Wickwire-Spencer Steel Corporation, of Worcester, Mass., has recently accepted a position with the Wiley-Bickford-Sweet Co., Worcester, as credit manager.

GEORGE R. WOODS, general manager of R. S. Stokvis & Sons, Inc., New York City, has returned from a business trip to his home office in Holland.

FREDERIC HAVEY, foreign sales and relations manager for the Saco-Lowell Shops, manufacturers of cotton and textile mill machinery, Boston, Mass., recently returned from the International Textile Machinery Exhibition, in Bradford, England.

W. B. ANDERSON, manager of the Boston branch office of the Barber-Colman Co., manufacturers of milling cutters, hobbing machines, etc., Rockford, Ill., has been appointed a member of the finance commission of Swampscott, Mass., for a period of three years.

GEORGE MACNOE, manager of the Boston office of W. B. Connor, Inc., has been recalled to New York to take charge of the contractors' sales department, handling heating and pumping equipment.

J. S. TOOHEY, formerly with the Wallace Tractor Co., Racine, Wis., is now with the Racine Tool and Machine Co., as chief engineer.

A. A. HELLER has taken over the management of the International Oxygen Co., Newark, N. J., in place of L. W. Hench, secretary and general manager, resigned.

C. G. BIGELOW, formerly associated with the American Sheet and Tin Plate Co., has been appointed chief mechanical engineer of Jones & Laughlin Steel Co., at their South Side plant to succeed M. W. Hale who resigned recently.

FRED C. SEVERIN, formerly with the Betts Machine Co., and B. H. TRIPP, for a number of years associated with the Chicago Pneumatic Tool Co., have formed a partnership to deal in used machine tools, with offices at 25 Church St., New York City.

CHARLES E. BEESON has been elected vice-president of the Pittsburg Steel Co. He has been connected with the company since 1901 and has served as a director and member of the executive committee.

W. C. REITZ, secretary and treasurer of the Pittsburg Steel Products Co., has been made a director of the Pittsburg Steel Co.

E. R. SMITH has been made vice-president of the Fitchburg Machine Works, makers of the Lo-Swing lathe.

L. F. CARLTON, for eighteen years connected with the Consolidated Press

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Nibbling Machine, Rapid

A. C. Campbell, Inc., Waterbury, Conn.

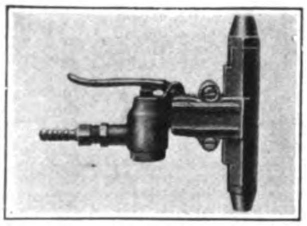
"American Machinist," October 12, 1922

The machine is for cutting irregular forms from sheet metal, celluloid, or fiber and is a small punch press that does its cutting by means of a cylindrical punch and die. The work may be pushed or pulled in any direction by hand, or the machine follows a templet attached to the sheet. The punch has a central pilot, and the ram is so set that this pilot does not at any time come above the surface of the work. Closed outlines may be cut. With an attachment, circles of any size up to 28 in. in diameter can be cut. The double-ended reversible punches are about $\frac{1}{16}$ in. in diameter.

Vibrator, Pneumatic, for Foundry Use

Malleable Iron Fittings Co., Branford, Conn.

"American Machinist," October 12, 1922



The vibrator or "rapper" is intended for use chiefly in the core-rooms of foundries for rapping core driers or core boxes when removing cores. It operates upon the principle of a pneumatic hammer, but is not intended to deliver a blow of any moment. It may be used anywhere that a supply of air under a pressure of 20 lb. or greater is available. It may be kept on the molding bench, so that it can be picked up as readily as a mallet and pressed against the work.

Casehardening Compound, "Nitrol"

American Kreuger & Toll Corporation, 522 Fifth Ave., New York, N. Y.

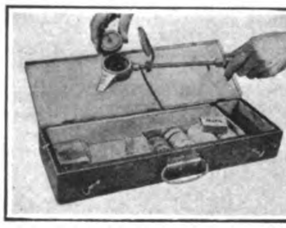
"American Machinist," October 12, 1922

The compound is a nitrogenous powder that can be employed for surface-hardening iron and steel under practically any condition. Rusty objects can be hardened as well as polished ones. The compound is furnished in two grades, Grade A being used for surface hardening and Grade E for pack hardening to depths up to $\frac{1}{16}$ in. The Grade A or sprinkling powder melts at 1,200 deg. F., and does not give off poisonous or obnoxious fumes. Cast steel or alloy pots similar to those employed for cyanide may be used. When carburizing in pots, the parts are packed with Grade E Nitrol and then heated in the usual manner up to 1,475 to 1,550 deg. F. for from three to eight hours. The parts are removed and quenched in the usual manner, either directly from the box or reheated to 1,425 deg. F. and quenched.

Soldering Iron, Heated by Chemical Action

International Sales Co., 921 Southern Bldg., Washington, D. C.

"American Machinist," October 19, 1922

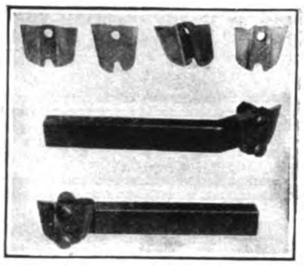


The soldering iron does not employ heat from an outside source, but utilizes chemical reaction to bring it to the proper temperature. In a receptacle cast in the soldering iron is placed a small tin container holding the required mixture. The head of a special match is inserted through an opening, a perforated lid closed over the receptacle and the protruding match-end lighted. Instantly an intense white glow appears through the holes in the lid and the iron is ready for use. The heat from this application lasts about 10 min. The iron and a supply of briquets and matches are housed in a metal-lined box with a hinged lid and handle.

Toolholder and Interchangeable Cutters, Combination

Morris Tool Co., Inc., 30 Church St., New York, N. Y.

"American Machinist," October 12, 1922

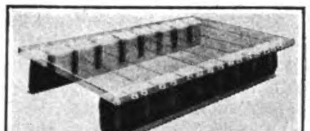


At the cutting end, the holders have two projecting arms in which bolts hold the cutters. By turning the holder over and fastening the blade on the other side the height of the cutting edge is changed. Both straight and angle holders can be furnished. Each blade has two cutting edges. They are made for turning, cutting-off, threading and facing. It is merely necessary to grind the top slope when sharpening cutters. The large cross-sectional area provides for conducting the heat from the cutting edge, so that heavy-duty work can be performed. Holder sizes, twelve, from $\frac{1}{2}$ x $\frac{5}{8}$ x 4 in. to $2\frac{1}{2}$ x 3 x 24 in. Blade thickness: from $\frac{1}{8}$ to $1\frac{1}{8}$ inches.

Platform, Lift-Truck, "Steeleg"

Barrett-Cravens Co., 1328 W. Monroe St., Chicago, Ill.

"American Machinist," October 12, 1922

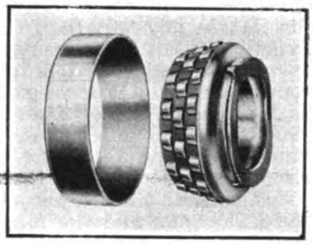


The top of the platform is made of wood and can be furnished from $\frac{3}{4}$ to 2 in. in thickness, depending upon the class of work for which it is intended. Flathead countersunk bolts fasten the boards to the steel legs or skids. The legs are made of heavy-gage flanged steel plate and have vertical ribs to prevent buckling. The upper flange has a wide bearing for the top, and a turned-up edge which protects the ends of the boards. The legs do not wear or shrink as wooden skids do, so that the truck can always be run under the platform.

Bearing, Roller, Radial and Thrust

Whitney Bearing Corporation, 467 E. Ontario St., Chicago, Ill.

"American Machinist," October 12, 1922

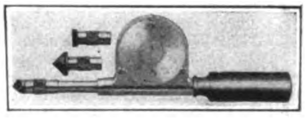


The rolling action is obtained in this bearing by means of cylindrical disks. The periphery of each disk is parallel to the axis, and the diameter is twice the thickness, regardless of size. Both conical surfaces of the bearing have the same angle. The rollers operate between parallel surfaces to eliminate the end thrust and friction occurring on tapered rollers. The load is transmitted to the face of the roller only in a direction perpendicular to the axis of the roller. The several series of rollers are carried in separate ring cages. The adjustment spring is automatic and keeps a uniform pressure on the bearing.

Indicator, Speed, No. 748

Brown & Sharpe Manufacturing Co., Providence, R. I.

"American Machinist," October 19, 1922



The indicator registers the number of revolutions of shafting, motors and revolving parts in either direction, and measures both high and low speeds equally well. The design of the indicator is different from that of the former models. The readings are taken on one side only. The device can be quickly set at zero and registers up to 5,000 revolutions by steps of five revolutions, although much faster speeds can be determined. The two arrows on the face of the dial indicate the figures to use for the different directions of rotation. The figures showing through the small round windows on the dial register steps of five revolutions directly. The small inside dial registers hundreds of revolutions. The fiber handle serves as an insulation for the operator against electricity. Three points are furnished, a steel point for ordinary speeds and rubber points for high speed.

Clip, paste on 3 x 5-in. cards and file as desired

Co., has been appointed Western sales manager of the V. & O. Press Co., designer and manufacturer of high grade power presses and sheet metal working machinery, Brooklyn, N. Y. He will make his headquarters at 549 Washington Boulevard, Chicago, where the company has established its office, and it is intended to carry a stock of presses in that city for immediate shipment.

Obituary

HEDLEY P. CARTER, vice-president, treasurer and sales manager of the H. C. Cook Co., manufacturers of sheet metal novelties and tools, Ansonia, Conn., died at his home in that city Nov. 19. Mr. Carter, who was 51 years old, and was very well known in manufacturing circles throughout the East. He came to the Cook Co., five years ago, from the Stanley Works, New Britain, Conn., with which concern he was associated for 16 years.

CHRISTIAN LOUIS BERGER, founder of and for sixty years actively engaged in the management of C. L. Berger and Sons Co., Boston, manufacturer of scientific instruments, died Nov. 19, at 80 years of age. Mr. Berger was born in Stuttgart, Germany, and came to America in 1862. He is survived by two sons, Louis H., and William A., both active in the management of the business.

HENRY L. KINSLEY, Wellesley, Mass., New England representative of the Warner & Swasey Co., machine tools, died Nov. 22, at the Natick Hospital, Natick, Mass., following an operation. Mr. Kinsley appeared on the road to recovery immediately after the operation, but on Tuesday serious complications developed. He was a native of Stoughton, Mass., and was born 68 years ago. Practically all his business life was spent in the machine tool industry. He represented the Warner & Swasey Co. with offices at Boston for more than 15 years, and probably was one of the best known machine tool men in the New England territory. Previous to his association with the company he was with the Fairbanks and the Manning, Maxwell & Moore companies.

Book Reviews

The Manufacture and Uses of Abrasive Materials. By Alfred B. Searle. One hundred twelve 4 x 6½ in. pages, illustrated. Cloth boards. Published by Isaac Pitman & Sons, 2 W. 45th St., New York, N. Y. Price 85 cents.

This book is one of a series known as Pitman's Technical Primers. It is a brief, well written book on grinding, to be recommended, among other reasons, because it is elementary. Beginning with definitions of abrasives and the action of removing metal by grinding, the reader is led through chapters on raw materials, preparation of abrasive materials, manufacture of abrasive blocks, wheels, papers and cloths, polishes, selection of abrasives, testing abrasives and polishes, and the erection and operation of machines and wheels.

No attempt is made to give elaborate descriptions and illustrations of individual grinding operations, nor are the practices of individual concerns related. In that respect generalities are adhered to, the author satisfying himself with explaining the various kinds of grinding machines and operations. Definitions are plentiful and well stated. On the whole, a valuable book.

Stores and Materials Control, Including Procurement by Manufacture and by Purchase. By Madison Cartmell, Consulting Industrial Engineer. Four hundred forty-five 6 x 9 in. pages, with illustrations of report and record forms. Cloth boards. Published by the Ronald Press Co., 20 Vesey St., New York, N. Y. Price $4.50.

This book is characterized by its thoroughness and its clarity. The author did a hard job well and did not quit until he was through. In scope, the book is pretentious, undertaking to cover principles of materials control, procurement by manufacture, procurement by purchase, and the problem of what system to adopt. Yet when the importance of stores and materials control is realized, it is seen that the whole field, as chosen by the author, must be covered, in order to make a book sufficiently comprehensive for the needs of management. Such realization justifies the treatment of the general subject of the procurement and handling of materials, from the initiation of the order for their purchase of manufacture to the shipment of the finished product.

The first part, under the general heading "Introductory," treats of the problem of materials control and the organization of control.

Part two, "Principles of Control," takes up the records and mechanism of control, the stores record form, pricing the stores records, operating the stores records, classification and symbolization, symbolization of cost records, the costing of orders, control of inventory, standards and specifications, arranging and equipping the storesroom, stowing material, taking inventories, organization of the materials control department.

The third part, "Procurement by Manufacture," includes the subjects of organization of the production control department, graphic production control, operation of production control mechanism.

Part four, "Procurement by Purchase," tells of the function of the purchasing department, the article, the market, seller and buyer, the price, the written contract, effecting the delivery, the completion of the purchase contract, some legal aspects of purchasing, organization and personnel.

Part five, "Adopting a System" explains systems, records and forms.

While the subject of materials control has been explained as it applies to both large and small organizations, it is treated more particularly from the viewpoint of the large plant. That viewpoint was taken because the author believes that "basic principles apply to both classes alike," and that "the only safe policy for the small plant that is to hold its own lies in simplifying and adapting the methods tested out in the big plant and found essential to sound operation, without slurring over or emasculating them."

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Electric labor-saving devices, fractional horsepower electric motors, electric lamp shades and fittings, wireless sets and appliances, felts of all kinds, canvas, duck, and leather cloth, linoleums, automobiles-hood cover materials, pressed and molded glassware, glass lamps, chimneys, tools, emery, flint, and glass paper, general hardware, especially patented hardware—Australia. Agency desired. Terms, cash against documents. Reference No. 4432.

Electrical supplies, such as lamp cord, fixtures, glassware, electric globes, motor appliances, heater appliances, insulators, dry and wet batteries and specialties—Peru. Agency from manufacturers desired by representative in the United States. Reference No. 4439.

Steam engine of 50 horsepower, to be supplied by an existing English water tube boiler with pressure of 120 pounds; also punching and slotting machinery; high-speed machine lathes; band saw for steel, leather, and wood; and small furnace for iron and brass foundry, with crucible one-half ton capacity—Brazil. Purchase desired. Quotations, c.i.f. Brazilian port. Terms, cash against documents. Reference No. 4490.

Trade Catalogs

Portable Electric Tools and Shop Equipment. The Black & Decker Manufacturing Co., Baltimore, Md. Catalog No. 5 for 1923 which has just been issued by this company is a fine example of the printer's art and the Black & Decker organization deserves praise for the excellent arrangement of the illustrations and subject matter. The company's complete line of portable electric tools and shop equipment devices is shown with an illustration for each type. The complete specifications with other matter of general interest is set forth for each machine. Featured in the publication also are the company's lectroflater electric compressor, the No. 2 hand lectroflater, the No. 2 wall lectroflater and the No. 2 carriage lectroflater.

Drill Presses. The Sibley Machine Co., South Bend, Ind. This company has issued a new catalog describing the features of its line of single spindle drill presses. Points of especial interest are described in detail and specifications for each type are included.

Lithoform. The American Chemical Paint Co., 1126 South Eleventh St., Philadelphia, Pa. A process for making paint hold to galvanized iron is described in a new publication, Bulletin No. 9-B, just issued by this company. The publication tells what Lithoform does, gives directions for its use and treats of the Lithorizing process as applied to galvanized iron.

Multi-Graduated Precision Thread Grinders. The Precision and Thread Grinder Manufacturing Co., 1932 Arch St., Philadelphia, Pa. A new catalog, consisting of bulletins, in loose-leaf binder, has just been issued by this company containing a general description of its line of products. The various styles of machines are illustrated with a detailed discussion of the construction, use and maintenance of each.

Forthcoming Meetings

Eighteenth Annual Automobile Salon, Commodore Hotel, New York City, December 3 to 9, 1922.

American Society of Mechanical Engineers, annual convention. December 4 to 7, 1922, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

American Institute of Weights and Measures, annual meeting December 8, 1922, United Engineering Societies' Building, 29 West 39th St., New York City. Chas. C. Stutz, 115 Broadway, New York City, is secretary.

National Exposition of Power and Mechanical Engineering. Dec. 7 to 13, 1922, Grand Central Palace, New York City. Secretary, Calvin W. Rice, 29 West 39th St., New York City.

National Automobile Chamber of Commerce, National Automobile Show, Grand Central Palace, New York City, January 6 to 13, 1923.

National Automobile Chamber of Commerce, Nationa Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

Universal Patent Exposition, First Annual Convention and exhibit of patents and inventions, Grand Central Palace, New York City, February 17 to 22, 1923. A. B. Cole, 110 West 40th St., New York City, is chairman.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21, Engineering Societies' Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

New and Enlarged Shops

Machine Tools Wanted

Ala., Attalla—Attalla Motors Co.—machine shop equipment.

Conn., New Britain—B. F. Clark, South Main St.—equipment for proposed automobile service station.

Ia., Dubuque—Belsky Motor Co., 6th and Iowa Sts.—repair machinery for garage, including lathe, drill press, air compressor, etc.

Kan., Wichita—G. Manlove, 115 West 2nd St.—South Bend power lathe, (used preferred).

Ky., Louisville—Pittsburg Fuel Co., 231 West Main St.—16 or 18 in. lathe with power attachment.

Mass., Boston—Keystone Mfg. Co., 53 Wareham St., (manufacturer of metal toys) —geared type punch press with 4 in. stroke, Bliss or Consolidated preferred (used).

Mich., River Rouge—Whitehead & Kales, South Dearborn St., (structural steel and machine work), M. Davis, Purch. Agt.—complete tool and die room equipment; also machine shop equipment, including lathes, millers, shapers and multiple drill.

Mo., Webster Groves—Webster Groves Auto Repair Co.—medium size power punch press.

N. Y., Buffalo—J. Ballatin, 1722 Jefferson St.—machinery, tools and equipment for $75,000 automobile sales and service station.

N. C., Raleigh — Structural Supply Co., Box 1133, (steel and iron products), D. B. Irwin, Purch. Agt.—sheer and punch, 6 x 3½ in. angles, 6 x ½ in. flats, ¾ in. through ¾ in.; lathe for bolt threading, 1½ in. max.; small drill press, 1½ in. through 1 in.; forge, rivet portable Hand blower; bar bender, 1 in. square, cold bend; also equipment for light structural plant (used.)

O., Cleveland — Cuyahoga Boiler Wks. Co., 1210 Main St.—belt driven power punch, 18 to 22 in. throat, to take ¾ in. hole in 3.4 in. material (new or used).

O., Cleveland—W. L. Streit, 2336 West 42nd St.—one 36 in. bar folder and a 36 in. squaring shears.

O., Columbus — C. J. Maddox, 16 East Broad St.—compressor, blacksmith and machine shop equipment for the Buckingham Mines, Ltd., Asquith, Twp., Ont.

O., Dayton—G. W. Shroyer & Co., 2nd and Main Sts.—machinery, tools and equipment for automobile sales and service station.

Pa., Pittsburgh—Pittsburgh & Lake Erie R.R., South Smithfield St., C. M. Yohe, Purch. Agt.—42 in. boring mill with side head; also a 24 in. shaper.

Va., Ashland—Fuqua & Stone (automobile repairing)—drill press.

Va., Ashland—Rawlings Motor Co.—drill press.

Va., Fredericksburg—City Repair Shop, City Manager, Purch. Agt.—10 ft. lathe and drill press.

Va., Fredericksburg—Dice Motor Co.—lathe and drill press.

Va., Fredericksburg—Fredericksburg Motor Co., 613 Princess Anne St.—drill press.

Va., Fredericksburg—A. S. Haislip Motor Co., Princess Anne St., L. Bowie, Purch. Agt.—lathe for repair shop.

Va., Fredericksburg—Horton & Simpson, 105 Commerce St.—reamer for automobile repair shop.

Va., Fredericksburg—C. M. Humphry & Son, 605 Commerce St.—lathe and drill press for automobile repair work.

Va., Fredericksburg—W. B. Jenkins, 65 Princess Anne St.—25 cycle motor, single phase, 110 volt a.c.; also lathe.

Va., Fredericksburg—Jones Motor Co.—shop tools, wrenches, vise, etc.

Va., Fredericksburg—Service Motor Co.—lathe, drill and bench tools.

Va., Hopewell—F. Bowles—lathe, drill press and other machinery for automobile repair shop.

Va., Hopewell—Petersburg Motor Co.—lathe, drill press, etc.

Va., Hopewell—Red Front Garage—lathe and drill press.

Va., Richmond—Godsey & Fry, 718 East Cary St. (machine shop)—milling machine.

Va., Richmond—C. E. Johnson, 822 West Main St. (machine shop)—No. 3 or 4 milling machine, 20 in. lathe, 20 in. shaper, medium drill press and bench tools.

Va., Richmond—H. E. Lang, 10 South Madison St. (welding and repair shop)—large lathe.

Va., Richmond—Seventh St. Garage and Repair Shop, 7th and Leigh Sts., C. A. Skinner, Purch. Agt.—drill press.

Wis., Chippewa Falls—F. A. Bigler, 15 River St. (garage)—drill press, air tanks, gasoline storage tank and pump.

Wis., Eau Claire—Automobile Gasoline Gauge Mfg. Co., c/o E. G. Kuehl, 1607 Emery St.—machine tools and machinery for the manufacture of gauges.

Wis., Eau Claire—J. C. Blaski—automobile repair machinery for proposed garage.

Wis., Eau Claire—K. N. Knudson, 307 North Farwell St.—repair shop equipment and air tank for proposed garage.

Wis., Eau Claire—Paige-Ford Motor Car Co., Wisconsin and North Farwell Sts.—repair shop machinery for proposed garage.

Wis., Lancaster—Grant County, H. Mink, Highway Comnr.—drill press, chain hoist and grinders for repairing road machinery.

Wis., Milwaukee—W. A. Sandrock Co., 1217 4th St. (structural steel)—punch press.

Wis., Waupun—Landaal Bros. Co.—automobile repair machinery for proposed $50,000 garage.

Wis., Wausau — Hall Garage Co., 107 Scott St.—automobile repair machinery for proposed $40,000 garage.

Wis., Wisconsin Rapids — Wood County Bd., c/o E. Morris, Comr.—machine shop equipment.

Ont., Wiarton—G. Golden, Berford St.—complete equipment for proposed $45,000 garage and automobile repair shop.

Machinery Wanted

Calif., Los Angeles—R. J. Fleming, 506 Bryson Bldg.—cannery equipment for plant, capacity 20,000 cans per 10 hour run, tomatoes chief product; also saw mill equipment, to be used in connection with cannery to be erected in Mexico.

Calif., Orange—N. T. Edwards—ice manufacturing machinery.

Colo., Seibert—Seibert Settler (newspaper)—cylinder press for power equipment.

Conn., Bridgeport—J. H. Southey, 576 Gurdon St. (machinery dealer)—3 elevating trucks or transveyors, 18 x 30 in. bed, 8 to 10 in. rise.

Fla., Ocala—Marion County Ice Co.—electrical ice making machinery.

Fla., St. Petersburg—Times, P. Poynter, Purch. Agt.—No. 8 or No. 14 linotype machine.

Ga., Cogdell—Morse Lumber Co.—woodworking machinery, including boring and turning machines.

Ill., Chicago—Blue Valley Creamery Co., 700 South Clinton St.—butter making and cream separator equipment for proposed creamery at Duluth, Minn.

Ill., Chicago—United States Gypsum Co., 205 West Monroe St.—machinery and equipment for proposed gypsum block plant at Oakfield, N. Y.

Ind., Evansville—Mid-States Rubber Co., c/o J. Hopkins, Secy., Never Split Seat Co., Morgan Ave.—machinery and equipment for rubber products plant.

Ind., Indianapolis—N. Todd, 415 Lemcke Bldg.—ice manufacturing and cold storage machinery and equipment.

Ind., New Haven—New Haven Silk Hosiery Co., H. Bauer, Purch. Agt.—labeling machines, bobbins and skein winding machinery.

Ia., Dubuque—P. T. Bowen, 2127 Gold St.—special mixing machinery for the manufacture of magnesite stucco.

Kan., Baxter Springs—Dr. J. H. Boswell—zinc mill equipment, crushers, rollers, belting, pulleys, shafting and bearings (used preferred).

Kan., Wichita—Business Printer, St. Croix Hotel, 116 North Topeka Ave.—job printing equipment.

Kan., Wichita—C. W. Owens, c/o G. W. Miller, 112 East 2nd St. (job printer)—power job press with Miller feeder (used).

Kan., Wichita—G. Roderick, 1112 East Douglas Ave.—Barned saw machine, jig saw, belting, planer, boring machine, Stanley miter box and small tools for cabinet making.

Ky., Louisville—National Forge Co., 1572 Cherokee Rd., W. Clark, Pres.—foundry equipment.

Me., Lewiston—W. S. Libbey Co.—machinery for new woolen mills at Hinsdale, Mass.

Md., Cambridge—Dorchester Fertilizer & Lime Co., L. Webster, Pres.—complete machinery and equipment for fertilizer plant (new).

Mass., Boston—Tileston & Hollingsworth Co., 49 Federal St.—additional machinery for paper plant at 892 River St., Hyde Park.

Mass., Gloucester — Savoy Dye House—additional machinery for laundry and dye house, including extractors, motors, etc. (used).

Mass., Waltham—Clayton Mfg. Co., 157 High St., (knit goods), E. Clayton, Purch. Agt.—one Scott & Williams, 18 in., 10 cut machine and one Shields automatic cutting and piling machine.

Mich., Detroit—G. B. Bright Co., Engrs., Marquette Bldg.—96 ton ice making machine for plant of Random Lake Ice Co., 064 Locust St., Milwaukee, Wis.

Mich., Detroit—Dept. Purchases & Supplies, 700 Marquette Bldg., Congress St., G. J. Finn, Comr.—one automatic electric welding outfit for the Dept. of Street Railways.

Mich., Detroit—Michigan Stamping Co., 11631 Mack Ave.—equipment for making metal stampings, for proposed addition to plant.

Mich., Highland Park—Ford Motor Co.—equipment, consisting of conveyors, transferring and assembling machinery for proposed assembly plant at Chicago.

Mich., St. Joseph—J. T. Townsend—refrigerating machinery (motor).

Mo., Chula — C. S. Steel — job printing press, newspaper press, paper cutter, linotype, belting, hangers, shafting, bearings and pulleys.

Mo., Joplin—Joplin Mchy. & Renting Co., 301 Virginia Ave., A. E. Maitland, Purch. Agt.—14, 16 and 18 in. rock crushers; also 24 and 26 in. rolls (used).

Mo., Joplin—Landreth Mchy. Co., 301-5 East 4th St. (machine shop)—vertical boilers, 3 to 12 hp.; also 2 air compressors up to 250 ft. capacity.

Mo., Joplin — White Mining Co., 1518 Kentucky Ave., O. White, Purch. Agt.—6 Chicago pneumatic air compressors, belting, hangers, shafting, crushers, rolls, bearings and gas engine.

Mo., St. Louis—The Bd. of Pub. Serv., 208 City Hall—Two 200 hp. oil burning, water tube boilers, 2½ ton ice plant and 10 ton refrigeration plant for proposed service station and power plant, at St. Louis Training School for Feeble Minded at Scott Farm.

Mo., St. Louis—G. A. Bull, 6026 Waterman Ave.—2 oil pumps and 2 tanks for filling station on Hogan and North Market Sts.

Mo., St. Louis—Grace Sign & Mfg. Co., 425 South Main St.—shafting and small machines for proposed sign factory on 2nd and President Sts.

Mo., St. Louis—Modern Auto Parts Co., 1803 Park Ave.—dollie, rectifiers and welding parts.

Mo., St. Louis—Oak Hill Express and Transfer Co., 3609 Gravois Ave.—550 gal. oil pump and tank for use at 4119 Fairview Ave.

Neb., Saint Edward—Advance—25 lb. light 12 point type, mailer and other printing equipment.

N. Y., Ashville—W. F. Meyer—machinery and equipment for cider mill to replace that which was destroyed by fire.

N. Y., Buffalo—Automatic Tire Machine Co., 19 Push St.—machinery and equipment for proposed factory for the manufacture of tire machines and appliances.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Copper outlook improved, electrolytic, quoted at 14⅜c. as against 14¼c. per lb., in New York warehouses. Zinc prices also working higher; 7⅝c. quoted, as compared with 7½c. per lb. last week. Lead market quiet with slight advance in East St. Louis. Linseed oil demand small but prices steady; lubricating oils, however, firmer in price with market slightly improved.

Declines—Pig-iron prices continue to decline. Steel shapes, plates and bars still frequently quoted under the $2 per 100 lb. level. Independent makers, however, adhere to the $2 base on steel plates; with attractive tonnages on railway equipment quoted as low as $1.90@$1.95. Heavy buying of tank plates, for oil storage continues.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.55
Northern Basic	30.27
Southern Ohio No. 2	30.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	35.27
BIRMINGHAM	
No. 2 Foundry	24.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	31.64
Virginia No. 2	37.17
Basic	27.50
Grey Forge	29.14
CHICAGO	
No. 2 Foundry local	30.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	30.00
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	27.50
Basic	27.50
Bessemer	30.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
New York	5.5
Chicago	4@5
Cincinnati	4.5
Cleveland	2.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50@2.60	4.19	3.70	4.00
No. 12	2.60@2.70	4.24	3.75	4.05
No. 14	2.70@2.75	4.29	3.80	4.10
No. 16	2.90@3.05	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11.	3.35@3.50	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.60	5.00	4.50	4.95
Nos. 17 and 21.	3.75@3.90	5.30	4.80	....
Nos. 22 and 24.	3.90@4.05	5.45	4.95	5.40
No. 26	4.05@4.20	5.60	5.10	5.55
No. 28	4.35@4.50	5.90	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
3/32	8.00		12@13
1/8	6.50		11@12
5/32 to 1/4	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.37½
Tin, 5-ton lots, New York	36.87½
Lead (up to carlots), St. Louis 6.95@7.00; New York	7.50
Zinc (up to carlots), St. Louis 7.05@7.10; New York	7.62½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7.25@7.37½	8.50	7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	29.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.50	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.75	9.25
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	6.50	6.75	7.00
Zinc	3.00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.50	11.00	14.50
IC,		112 sheets	12.80	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.90	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.65	
Coke, prompt furnace, Connellsville... per net ton		$7.25@7.50	
Coke, prompt foundry, Connellsville... per net ton		7.50@8.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1¼ and 1½x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ¾ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb.	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.50	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in.,			
No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

N. Y., Buffalo—Kittinger Furniture Co., 1893 Elmwood Ave.—machinery and equipment for furniture factory.

N. Y., Buffalo—J. H. Knepper & Sons, Inc., 1430 Main St.—machinery, tools and equipment for plumbing and steam fitting shop.

N. Y., Buffalo—National Brake Co., Ellicott Bldg.—machinery and equipment for proposed plant for the manufacture of brakes and brake equipment at Bridgeburg, Ont.

N. Y., Brooklyn—Wyona Knitting Mills, 493 Vermont St., G. Schwartz, Purch. Agt.—knitting machinery.

N. Y., East Aurora—Zapf Lumber Co.—machinery and equipment for new planing mill.

N. Y., Fort Covington — International Tape Co., J. F. LaCombe, Purch. Agt.—belt lacing machines.

N. Y., Geneva—Bd. Educ., C. W. Rice, Pres.—vocational equipment or proposed high school.

N. Y., Hamburg—Bd. Educ.—vocational equipment for $200,000 high school.

N. Y., Jamestown — Jamestown Store Front Co., 29 North Main St. (manufacturer and installer of store fronts and equipment)—complete machinery and equipment to replace that which was recently destroyed by fire.

N. Y., Johnson City—Endicott-Johnson Co. (manufacturer of shoes) — machinery and equipment for proposed factory at Binghamton.

N. Y., New York — L. Schlenker, 255 Center St (dies)—one 100 lb. drop hammer.

N. C., Anderson (Edenton P. O.)—Anderson Tractor Co., W. S. Anderson, Pres.—machinery and equipment for the manufacture of tractors.

N. C., Carthage—Sugg Bros. (machinists, etc.), L. R. Sugg, Purch. Agt.—portable keyway cutter and acetylene welding outfit.

N. D., Underwood — Underwood Dry Cleaners—dry cleaning machine.

O., Ashland—J. E. Matthews Produce Co.—cold storage machinery and equipment.

O., Columbus — Bd. Educ., Tower and High Sts., E. L. McCune, Clk.—receiving bids until Dec. 11 for two 12 in. speed lathes, three 30 in. band saws and other equipment for manual arts department.

O., Columbus—Columbus Brick & Terra Cotta Co., Kresge Bldg., W. T. Matthews, Purch. Agt.—brick making equipment for plant at Union Furnace.

O., Columbus—J. S. Maclean & Son, 150 West Spring St., (manufacturer of office furniture, etc.)—woodworking machinery, saws and planer.

O., Delaware—Automatic Incubator Co., W. McKenzie, Pres.—will take bids early in 1923 for woodworking machinery and some metal working equipment for incubator plant.

O. Ottawa—G. W. Kahle—woodworking machinery.

O., Sandusky — Blackwood Steel Fdry. Co.—foundry equipment for casting factory at Parkersburg, W. Va.

Pa., Allentown—V. B. Boyer, 242 North 11th St.—abattoir equipment, refrigeration machinery and cold storage equipment.

Pa., Ambler—E. Ott, 724 Rosemary St. (laundry)—washing machines, 4 or 6 pocket capacity.

Pa., Canton (East Canton) — Silverdale Creamery Co.—complete mechanical cooling system for milk plant.

Pa., Corry—D. A. Hillstrom—furniture manufacturing and woodworking machinery.

Pa., Freedom—Freedom Oil Wks. Co., E. Craig, Mgr.—span crane.

Pa., Germantown (Phila. P. O.)—Chetland Worsted Mills Co., Hains and Stanton Sts.—one Whitin quiller with one 378 spindle 2½ in. gauge; one Davis & Furber bobbin winder with 96 spindle (used).

Pa., Lebanon—Lebanon Honey Cake Cone Co.—cone making machinery for proposed factory.

Pa., Lebanon — Livingwood Mfg. Co. (manufacturer of metal stoves and camping outfits)—machinery and equipment for factory.

Pa., Marcus Hook — Cellulose Products Co., Inc., C. A. Cammillo, Purch. Agt.—braiding and twisting mcahinery.

Pa., McKees Rocks—Federal Enameling & Stamping Wks.—machinery and equipment for 3 story steel works.

Pa., Phila.—H. C. Aberle & Co., A and Clearfield Sts. (manufacturer of hosiery)—full fashion machines, sewing machines and loopers.

Pa., Phila.—Amer. Ice Co., 6th and Arch Sts.—conveyors, etc., for proposed ice plant on 17th St. and Washington Ave.

Pa., Phila.—Baccellieri Bros., 924 South 11th St., (manufacturers of furniture), P. Baccellieri, Purch. Agt.—turning machines, planers, saws, tenons etc.; also kilns for lumber for new factory at Berlin, N. J.

Pa., Phila.—Bennett & Aspden Co., Krams and Pechin Sts.—additional broad looms for proposed addition to textile mill for the manufacture of upholstery.

Pa., Phila.—P. Brosz, 2511 West Huntingdon St., (woodwork, etc.)—band saw, planers, etc., for new shop.

Pa., Phila. — Brown-Phelps Hosiery Co., 21st and Clearfield Sts., T. E. Brown, Purch. Agt.—additional knitting machines, etc.

Pa., Phila.—Bush & Diamond, Jasper and Thayer Sts.—broad looms and accessories for proposed rug factory.

Pa., Phila.—The city, 316 City Hall, T. F. Armstrong, Purch. Agt —50 ton refrigerating plant for city hospital.

Pa., Phila. — Continental Leather Co., Tacony St. and Van Kirk Ave.—additional leather working machinery for new plant.

Pa., Phila.—Stephen Green Co., 15th and Arch Sts.—presses and other printing equipment for proposed plant on 34th and Market Sts.

Pa., Phila. — Jones Printing Co., 1515 Sansom St., W. Jones, Purch. Agt.—presses, paper cutter and accessories for plant.

Pa., Phila.—Merchants & Evans Co., 2035 Washington Ave., A. Evans, Purch. Agt.—cutting machines, brakes, furnaces and sheet metal working machinery for new addition.

Pa., Phila.—J. H. Reed, 435 North Broad St.—automatic full fashion hosiery machines, etc. for new plant.

Pa., Phila.—Rodgers Engraving Co., 1318 Arch St.—machinery and equipment for proposed engraving and printing plant.

Pa., Phila.—Wolstencroft Felt Mfg. Co., Mulberry and Bridge Sts., I. H. Wolstencroft, Purch. Agt.—additional sets and finishers for the manufacture of felt.

Pa., Pittsburgh — Duquesne Steel Fdry. Co., Farmers' Bank Bldg.—equipment for foundry, to replace that which was destroyed by fire, at Kendall (Coraopolis P. O.).

Pa., Pittsburgh—D. L. Hamlin, Inc., 123 38th St.—grain conveying machinery.

Pa., Pittsburgh—Union Steel Casting Co., 62nd and Butler Sts.—crane.

Pa., Pottstown—G. W. Corbett, 63 High St. — foundry equipment for the manufacture of steel castings.

Pa., Pulaski—Pulaski Grist Mill, W. McConnell, owner—machinery and equipment.

Pa., Sharon—Sharon Furniture Mfg. Co., 288 Wilkes Pl.—saw and saw table.

Pa., Slatington—J. A. Brush—printing machinery and equipment for new 3 story plant.

Pa., Uniontown—Brown Coal Co.—electric coal tipple machinery and equipment.

Pa., Warren — Colonial Rug Wks., 410 Laurel St., C. M. Mayhood, Purch. Agt.—dyeing machinery and looms for the manufacture of rag and fluff rugs.

Pa., Watsontown—Watsontown Door & Sash Co.—machinery and equipment for addition to factory.

Pa., Williamsport—Standard Wood Pipe Co., East Jefferson St.—sawmill equipment.

Pa., Woodlawn—Bd. Educ.—equipment for vocational department of new $250,000 high school.

R. I., Pawtucket—Bd. Educ.—vocational equipment for proposed $1,200,000 high school.

R. I., Woonsocket—Rhode Island Knitting Co., Jeffers St.—equipment for proposed addition to knitting mill.

S. C., Greenville—E. M. Wharton, Davenport Apartments—stamped steel automatic loom stop, recently patented.

S. C., Kingsville (Gadsden P. O.)—Congaree Timber Land Co., J. E. Belzer, Pres.—lumber and sawmill machinery.

Tenn., Chattanooga—Continental Mchy. Co., G St.—machinery and equipment to replace that which was destroyed by fire.

Tenn., Chattanooga—Gager Lime & Mfg. Co., James Bldg., M. P. Kennedy, Secy.—stone washer and crushing machine, 200 ton capacity.

Tenn., Memphis — DeSoto Hardwood Flooring Co., 1014 Sledge Ave., R. A. Taylor, Mgr.—equipment for proposed addition to plant.

Tex., Bonham—Catron Mfg. Co. (manufacturer of pumps, etc.)—machinery and equipment for plant (new).

Tex., Canyon—Bd. Educ.—vocational equipment for $100,000 school.

Tex., Comfort—Faust Motor Co.—about a dozen pieces of sheet metal or tin working machinery.

Tex., College Station—A. & M. College Print Shop—proof press, stand, single and double galley press for power equipment.

Tex., Kerens—J. W. Maby & Co. (sheet metal)—8 or 10 ft. cornice brake.

Tex., San Antonio — Freeman Printing Co.—pony cylinder press, 25 x 38 in., Meihle preferred, power attachment.

Va., Alexandria — Herfurth Engine & Mchy. Co.—300 ft., 3 lb. air blower (used); oil engine, 75 to 100 hp. (used); 7½ x 7½ in., 9 x 9 in. and 10 x 10 in. ice machines, belt driven, enclosed type (used.)

Va., Ashland—R. J. Chisholm, R.F.D. 4—gas engine, mandrel and a 28 in. circular saw.

Va., City Point—Wilson-Hock Co., (machinery, etc.), N. Wilson, Mgr.—8 in. steam separator; rotary dryer about 7 ft. diameter, 90 ft. long, to dry with direct or semi-direct heat 50 ton of limestone per hour; outfit to dry-grind mica to 75 or 80 mesh.

Va., Fredericksburg—J. E. Brickert & Co., 903 Charles St.—test bench complete with armature winder and under cutter, also small lathe and electric hand motor.

Va., Front Royal—Proctors Grist Mills—complete machinery to replace that which was destroyed by fire.

Va., Hopewell—Hopewell China Plant—clay working machinery.

Va., Hopewell—Hopewell Printing Co.—pony press.

Va., Hopewell—Tubize Artificial Silk Co., J. L. Brown, Purch. Agt.—spinning machinery.

Va., Richmond—Allegheny Box Co., 601 Byrd St. (manufacturer of wooden boxes)—multiple boring machine.

Va., Richmond—S. E. Kane, 119 South Lombardy St. (printing)—cutting and stapling machines, also job press.

Va., Richmond—E. T. Macdowell, 203 East Main St.—12 x 18 in. job press, paper cutter and stapling machine.

Va., Richmond—Palace Steam Laundry, 303 West Cary St., C. D. Griffis, Purch. Agt.—3 washers, one 26 in. extractor and collar and cuff machinery.

Va., Richmond — Richmond Corrugated Paper Co., 7th and Byrd Sts.—combination roll, rewinder and sheet chopper.

Va., Richmond—R. A. Siewers, 612 Cumberland St. (contractor)—4 siding machines.

Va., Richmond—T. & E. Laundry Co., Inc., 926 West Broad St., L. E. Hardy, Purch. Agt.—whole shirt unit, collar and cuff machinery and 2 large washers.

W. Va., Charleston—Griffith, Foster & Rhodes—equipment for the manufacture of skylights, blow pipes, heating systems, etc.

W. Va., Glen White—E. E. White Coal Co.—machinery and equipment for proposed coal tipple.

Wis., Belgium—Krier Preserving Co.—canning machinery, belting, shafting, power equipment, including boilers, engines, pumps and steel stack for cannery at Random Lake.

Wis., Crandon—F. H. Himes—planing and sawing machinery for proposed saw and planing mill.

Wis., Eau Claire — Lang Canning Co., Mill St.—canning machinery, belting and shafting for proposed addition to cannery.

Wis., Green Bay—J. C. Krueger, 1009 Crooks St.—sheet metal working machinery.

Wis., Hartland—J. Hurley—dairy and power machinery for proposed factory at Hustisford.

Wis., La Crosse—Anderson Vulcanizing Co., 215 State St.—vulcanizing equipment.

Wis., Madison—Karnack Studios Co., 24 East Wilson St., T. Munchow, Purch. Agt.—equipment for the manufacture of incense burners, metal and plastic art novelties, etc.

Wis., Madison — Madison Supply Co., 615 East Washington Ave.—power and bottling machinery for proposed bottling works.

Wis., Menomonie—Dunn County, F. Stewart, Comr.—$12,750 worth of road machinery, including patrol graders and equipment for county repair shop.

Wis., Milwaukee—C. Daniel, 1741 Teutonia Ave. (carpentry and millwork)—one band saw.

Wis., Milwaukee—Excel Mfg. Co., 3402 South Pierce St. (millwork) — additional woodworking machinery.

Wis., Milwaukee—P. Hoff, 64 Locust St.—ice making machinery, electrically driven.

Wis., Milwaukee—Milwaukee Auto Specialty Mfg. Co., 711 Chestnut St., W. J. Raley, Purch. Agt.—one paper press.

Wis., Milwaukee—Milwaukee Enameling Co., 406 6th Ave., J. M. Reitzler, Purch. Agt.—enameling ovens.

Wis., Milwaukee—Milwaukee Times, 349 Grove St., H. Towell, Purch. Agt.—one stereotyping outfit and one cylinder press. motor power.

Wis., Milwaukee—Palmolive Co., 42 4th St.—soap making machinery and kettles for proposed addition to factory.

Wis., Milwaukee—J. J. Tadyck, 1394 8th Ave.—sheet metal working machinery.

Wis., Milwaukee—Vollbrecht Cut Stone Co., 753 Canal St., A. J. Vollbrecht, Purch. Agt.—traveling crane.

Wis., Milwaukee—Wisconsin Steel & Dock Co., 253 3rd St., (marine repairs, etc.), F. W. Stevens, Purch. Agt.—power saws.

Wis., Rosholt—M. C. Colrud—feed grinding machinery with gasoline engine or motor power.

Wis., Wausau—Marathon Shoe Co., 1st Ave. and Cedar St.—additional shoe working machinery for proposed factory.

B. C., Kilgard—Comrs. of Sumas Dyking Dist.—receiving bids until Dec. 28 for an 8 ton hand operating traveling crane. Estimated cost $4,000. G. P. Moe, Kilgard, Engr.

N. B., St. Johns — Stephen Brick Co., Prince William St.—machinery and equipment to replace that which was destroyed by fire.

N. B., St. Johns—Stetson-Cutler & Co.—sawmill equipment.

Ont., Collingwood—Canadian Postal Lock Nut Bolt Co., F. A. Bassett, Mgr.—equipment for the manufacture of bolts, screws and rivets, later for steel stamping.

Ont., Ford — Ford Motor Company of Canada, P. W. Grandjean, Secy.—special metal working machinery for the manufacture of autos and tractors.

Ont., Goderich—W. Baechler—machinery and equipment for proposed woodworking plant and sawmill.

Ont., Hamilton—Duro Constr. Co., Ltd., 306 Landed Bank Bldg., C. W. Bowser, Purch. Agt.—woodworking and general contractors equipment.

Ont., Harrow—T. R. Flood Flour Mills—equipment to replace that which was destroyed by fire.

Ont., Mount Dennis—Electroplax Co. (manufacturer of insulation equipment)—machinery and equipment for plant to replace that which was destroyed by fire.

Ont., Owen Sound—Bd. Educ., W. H. Wright, Chn.—general equipment, including tools, woodworking and metal working lathes, etc., for proposed technical school, physics and chemistry laboratories.

Ont., Paris—Penmans Ltd.—equipment for proposed woolen mill at St. Hyacinthe, Que.

Ont., Petrolea—B. P. Corey—special equipment for making oil, grease and soaps for proposed factory.

Que., St. Lambert—J. Duncan—sawmill equipment to replace that which was destroyed by fire.

Ont., St. Marys — W. Zurbrigg, c/o J. H. Jameson—complete equipment for proposed saw and planing mill at Rannoch.

Ont., Stratford — Stratford Frames & Novelties—woodworking machinery, (new).

Ont., Welland—Welland Cotton Co., J. T. Grantham, Pres.—machinery and equipment for proposed cotton mill.

Ont., Wiarton—Gilpin Bros.—$30,000 worth of woodworking machinery and equipment for the manufacture of flooring and woodenware specialties.

Que., Montreal—Thomas Gold Mining Co., Ltd., 810 Drummond Bldg., T. H. Carveth, 227 Girouard Ave., Pres.—stamp mill and other machinery for mine in Thomas Twp., Porcupine Mining Division, Ont.

Metal Working Shops

Conn., Plantsville—The Blakeslee Forging Co. awarded the contract for the construction of a 2 story, 40 x 42 ft. forge building. Estimated cost $15,000. Noted Oct. 19.

Conn., Waterbury—The Brass City Machine & Tool Wks., 29 Pearl St., is receiving bids for the construction of a 2 story addition to its factory for the manufacture of special machinery. Estimated cost $40,000. L. S. Kipp, 121 Charles St., Engr. and Archt.

Mass., Cambridge—The Cambridge Motor Co., 195 Massachusetts Ave., awarded the contract for the construction of a 2 story, 55 x 200 ft. garage and automobile sales and service station, with 62 x 66 ft. wing, on Massachusetts Ave. and Front St. Estimated cost $150,000.

Minn., St. Paul—The Hamm Realty Co., 681 Minnehaha St., plans to build a 2 story, 150 x 150 ft. garage on 8th and Sibley Sts. Estimated cost $100,000. Architect not announced.

Mo., St. Louis—The Auto Car S. & S. Co., Locust and Leffingwell Sts., awarded the contract for the construction of a 1 story, 134 x 155 ft. garage and service station at 2740 Locust St. Estimated cost $60,000.

Mo., St. Louis—The Automatic Sprinkler Co., c/o T. Sheehan Plumbing Co., 15th and Olive Sts., awarded the contract for the construction of a 2 story, 40 x 110 ft. sprinkler assembly plant, on Olive St. Estimated cost $25,000.

Mo., St. Louis—The Haynes-Langenberg Mfg. Co., 4045-57 Forest Park Blvd., will soon award the contract for the construction of a 3 story, 150 x 200 ft. furnace factory on Bircher St. near Euclid St. C. W. Morton, 1339 Syndicate Trust Bldg., Engr. G. O. Langenberg, c/o owner, Archt. Noted Nov. 23.

N. H., Manchester—C. H. Macrury, 1042 Elm St., awarded the contract for the construction of a 3 story, 50 x 50 ft. garage on Burch and Lowell Sts. Estimated cost $50,000.

N. Y., Brooklyn—M. Galtabiano, c/o T. Goldstone, Engr. and Archt., 50 Graham Ave., will build a 1 story, 100 x 100 ft. garage on Decatur St. and Wyckoff Ave. Estimated cost $40,000.

N. Y., Buffalo—The Williams Gold Refining Co., 2978 Main St., plans to build an addition to its factory. Estimated cost $10,000. Architect not announced.

N. Y., Lackawanna (Buffalo P. O.)—The Lackawanna Steel Co. is having plans prepared for the construction of additions to mills, also new rail and steel mills, furnaces and various shops. Cost will exceed $15,000,000. W. A. James, Ch. Engr.

N. Y., Rochester—The Rochester Taxicab Co., 58-64 Plymouth Ave., N., awarded the contract for the construction of a 2 story, 90 x 200 ft. garage. Estimated cost $125,000.

O., Dayton—The G. W. Shroyer Co., 2nd and Main St., is having plans prepared for the construction of a 2 story, 50 x 200 ft. automobile sales and repair station on North Main St. Estimated cost $60,000. Private plans.

O., Norwood—The Chevrolet Motor Co., General Motors Bldg., Detroit, awarded the contract for the construction of a 2 story, 320 x 500 ft. automobile assembly plant on Smith Rd., here. Noted Nov. 16.

O., Springfield — The Fairbanks Piano Plate Co., Kenton St., plans to rebuild portion of its factory, which was recently destroyed by fire. Estimated cost $40,000.

O., Toledo — The Chevrolet Motor Co., General Motors Bldg., Detroit, awarded the contract for the construction of a 1 story, 91 x 450 ft. automobile transmission plant, here. Estimated cost $225,000.

Pa., Erie—The Northwestern Motors Co., 21st and State Sts., plans to rebuild its factory which was recently destroyed by fire. Estimated cost $200,000.

Pa., Kendall (Coraopolis P. O.)—The Duquesne Steel Fdry. Co., Farmers' Bank Bldg., Pittsburgh, plans to rebuild major portion of its foundry, which was destroyed by fire, here. Estimated cost $300,000.

Pa., Lewistown—The Amer. Refractories Co., Union Arcade, Pittsburgh, has purchased a 68 acre site, here, and will build a plant in the spring.

Pa., New Castle—The National Radiator Co., Central Ave. and Ohio St., Johnstown, will build a 1 story, 30 x 365 ft. addition to its foundry, here.

Pa., Phila.—The Abrasive Co., Tacony and Froley Sts., awarded the contract for the construction of a 1 story, 80 x 120 ft. factory. Estimated cost $8,000.

Pa., Phila.—P. Dandolfi, 41st and Poplar Sts., is receiving bids for the construction of a 2 story, 50 x 200 ft. garage on Wyoming and Mascher Sts. Estimated cost $75,000. Neubauer & Supowitz, 929 Chestnut St., Archts.

Pa., Phila.—The General Electric Co., Witherspoon Bldg., awarded the contract for the construction of a 6 story addition to its switch factory on 7th St. and Willows Ave. Estimated cost $80,000. Noted Oct. 5.

Pa., Pittsburgh—The Englert Mfg. Co., 2133 East Carson St., awarded the contract for the construction of a 2 story, 68 x 120 ft. battery factory on South 25th and Jane Sts. Estimated cost $75,000. Noted Sept. 7.

Pa., Pittsburgh—The Neely Nut & Bolt Co., 46 South 22nd St., awarded the contract for the construction of a 1 story, 120 x 150 ft. and 21 x 113 ft. bolt plant. Noted Oct. 12.

Pa., Pittsburgh—The Pure Oil Co., Chestnut and High Sts., Columbus, O., is having plans prepared for the construction of a 1 story, 80 x 150 ft. garage, here. Private plans.

W. Va., Parkersburg—The Blackwood Electric Steel Corp. is receiving bids on steel for a 1 story, 140 x 230 ft. factory, for the manufacture of castings. Mill, Rhines, Bellman & Nordhoff, 1234 Ohio Bldg., Toledo, O., Archts.

Wis., Cedarburg — The Hansen Canning Machine Co., Port Washington, is receiving bids for the construction of a 1 story, 112 x 112 ft. factory, here. Estimated cost $40,000. Private plans.

Wis., Fond du Lac—The Gurney Refrigerator Co., 64 South Brook St., awarded the contract for the construction of a power house and 3 story, 60 x 140 ft. factory for the manufacture of refrigerators. Estimated cost $60,000. E. G. Vail, Pres.

Wis., Kenosha—C. O. Augustine, Archt., is receiving bids for the construction of a 1 story, 82 x 125 ft. garage for W. Russell, 603 Milwaukee St. Estimated cost $40,000.

Wis., Manitowoc—The Aluminum Specialty Co., 17th and Wollmer Sts., awarded the contract for the construction of a 3 story, 52 x 149 ft. factory and warehouse. Estimated cost $40,000.

Wis., Manitowoc — The Van Lente-St. Clair Corp., 405 West Walnut St., Green Bay, plans to build a 2 story, 57 x 110 ft. garage and repair shop, here. Estimated cost $45,000. B. L. Van Lente, Mgr.

Wis., Milwaukee—The Harley-Davidson Motor Co., 3732 Chestnut St., is having plans prepared for the construction of a 1 story, 80 x 145 ft. addition to its factory. Estimated cost $45,000. Fereral Engr. Co., 444 Milwaukee St., engrs.

Wis., Milwaukee—Leiser & Holst, Archts., 105 Wells St., are receiving bids for the construction of a 1 story, 45 x 115 ft. addition to factory for the Milwaukee Gas Specialty Co., 2017 Clybourn St. Estimated cost $40,000.

Wis., Milwaukee—M. S. Mann, 1219 Holton St., awarded the contract for the construction of a 1 story, 50 x 110 ft. garage on 4th St. Estimated cost $40,000.

Wis., Milwaukee—The Milwaukee-Western Fuel Co., 120 Wisconsin St., awarded the contract for the construction of a 1 story, 120 x 140 ft. repair shop on Clinton St. Estimated cost $60,000.

Wis., Milwaukee—J. M. Nash, 842 30th St., manufacture of special woodworking machinery, awarded the contract for the construction of 1 story, 25 x 70 ft. and 23 x 90 ft. additions to factory. Estimated cost $8,000.

Wis., Waukesha—The Spring City Auto Co., 220 West Main St., is receiving bids for the construction of a 1 story, 65 x 190 ft. garage and repair shop. Estimated cost $40,000. B. Wolf, Mgr. Private plans.

Wis., Waupun — The Althouse-Wheeler Co. will build a 2 story factory for the manufacture of steel towers, wind mills, tanks, etc. Estimated cost $50,000. H. O. Thompson, Mgr.

Wis., Wausau—Oppenhamer & Obel, Archts., Wausau, are receiving bids for the construction of a 2 story, 60 x 60 ft. garage, for the Durant Motor Car Co., 208 Washington Ave. Estimated cost $45,000.

Wis., Wisconsin Rapids—The Prentiss-Wabers Co. plans to build a 2 story, 50 x 110 ft. factory for the manufacture of heating devices for tourists, including enameling, assembling and testing rooms. Estimated cost $50,000. Architect not selected.

Ont., Ford—The Ford Motor Co. of Canada has had plans prepared for the construction of a 1 story, 570 x 1088 ft. and a 2 story, 65 x 1088 ft. machine shop additions to automobile factory. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., Archt.

Ont., London—Middlesex Motors, Ltd., 781 Dundas St., awarded the contract for the construction of a 1 story, 76 x 200 ft. garage and automobile repair shop. Estimated cost $65,000. F. B. Isaacs, Mgr. Noted Oct. 5.

Que., Montreal—Quebec Liquor Comrs., Delormier St., awarded the contract for the construction of a 75 x 100 ft. garage. Estimated cost $50,000. Noted Sept. 21.

General Manufacturing

Calif., Isleton—J. F. Butts Co., 2 Pine St., San Francisco, subsidiary of Warmington-Duff Co., 2 Pine St., San Francisco, is receiving bids for the construction of a 1 story cannery, 100 x 260 ft. main building, 80 x 120 ft. warehouse, 36 x 200 ft. wharf, 30 x 70 ft. canhouse and boiler room building, also 30 cottages for employees and apartment house to house 200 families, here. Estimated cost $150,000. W. J. Miller, 417 Market St., San Francisco, Archt.

Calif., Lodi—The Trustees of Lodi Union High School District will receive bids until Dec. 7 for the construction of a 2 story science building, a 2 story auditorium, 1 story manual training buildings, swimming tank and alterations to present structures. Estimated cost $250,000. Wright & Satterlee and L. S. Stone, Bank of Italy Bldg., Stockton, Archts.

Calif., Newman—The National Ice Cream Co., 371 Guerrero St., San Francisco, is receiving bids for the construction of a 2 story ice cream plant, here. Wieland-Mazurette-Wieland, 1002 H St., Modesto, Archts.

Calif., San Diego—M. J. Lyon, Engr. and Archt., 521 Union Bldg., is receiving bids for the construction of a gas plant for 7,000 population, at Tia Juana, Mexico, for the Zarocoza Investment Co., 521 Union Bldg., who has purchased a 645 acre town site there.

Calif., San Francisco—The General Mfg. Co., Pacific Bldg., awarded the contract for the construction of a 1 story, 140 x 192 ft. box factory on Railroad, Paul and San Bruno Aves. Estimated cost $35,000. Noted Nov. 16.

Calif., San Francisco—The National Ice Cream Co., 371 Guerrero St., awarded the contract for the construction of a 2 story ice cream plant on Guerrero St. near 16th St. Estimated cost $50,000.

Calif., San Francisco—The Reinhart Lumber & Planing Mill Co., 17th and Kansas Sts., has purchased a 5 acre site in the southern section of the city and plans to build a planing mill.

Calif., San Francisco—The San Francisco Chronicle, Chronicle Bldg., plans to build a newspaper plant, loft and office building on 5th and Mission Sts. M. D. De Young, owner.

Calif., Tracy—The General Milk Co. of California awarded the contract for the construction of a milk plant. Estimated cost $75,000. Noted Oct. 26.

Colo., Denver—The Blaney-Murphy Co., Stock Yards, is having preliminary plans prepared for the construction of a 5 story packing plant on 48th and Gilpin Sts. Estimated cost $750,000. Private plans.

Conn., Waterbury—Reymond Bros., 400 South Main St., awarded the contract for the construction of additions to its plant, consisting of a 1 story, 56 x 85 ft. garage and a 2 story, 40 x 80 ft. bakery. Estimated cost $40,000.

Ga., Atlanta—The White Provision Co., Howell Mill Rd., awarded the contract for the construction of a packing plant. Estimated cost $250,000.

Ill., Chicago—F. T. Hoyt, c/o A. S. Alschuler, Archt., 28 East Jackson Blvd., awarded the contract for the construction of a 3 story, 105 x 175 ft. printing plant on Congress and Laflin Sts. Estimated cost $250,000.

Ill., Chicago—Ronneberg, Pierce & Hauber, Archts., 10 South La Salle St., are receiving bids for the construction of a 1 and 2 story, 75 x 140 ft. laundry on Flournoy St. near La Vergne St., for the New Way Home Service Corp., c/o architects. Estimated cost $50,000.

Ky., Paducah — The Paducah Ice Co. plans to build 2 additional units to its ice manufacturing plant. Estimated cost $70,000. Architect not announced.

Mass., Clinton—Lockwood, Greene & Co., Engrs., 24 Federal St., Boston, will soon receive bids for the construction of an addition to dry and wet finishing departments and dyehouse, to contain about 15,000 sq.ft. of floor space, for the Roubaix Mills, 792 Main St., here.

Mass., Holyoke—J. Wisly, 18 Hitchcock St., awarded the contract for the construction of a 1 story, 20 x 32 ft. addition to printing plant. Estimated cost $6,500.

Mass., Pittsfield—The Pittsfield Coal Gas Co., South St., is having plans prepared for the construction of a 2 story addition to its gas plant. Cost between $15,000 and $20,000. Harding & Seaver, 7 North St., Archts.

Mich., Highland Park—The Ford Motor Co. awarded the contract for the construction of a 1 story transfer building on Manchester Ave. Estimated cost $400,000. Noted Nov. 2.

Mich., Lansing—W. S. Holmes, Archt., Tussing Bldg., will receive bids in the spring for the construction of a 4 story, 84 x 280 ft. cold storage plant on Kalamazoo St., for the United Produce Co., c/o Architect. Estimated cost $200,000.

Mich., Petoskey—The Petoskey Portland Cement Co. is having preliminary plans prepared for extending factory, stock house and power plant. Estimated cost $500,000. J. C. Buckley, 1st Natl. Bank Bldg., Chicago, Engr.

Minn., Morgan Park (Duluth P. O.)—The Universal Portland Cement Co. will build a 2 story, 18 x 100 ft. addition to its raw material mill and a 2 story, 68 x 247 ft. burner building. Estimated cost $249,500. Noted Aug. 3.

Mo., St. Louis—The Johansen Bros. Shoe Co., 3640 Laclede Ave., awarded the contract for the construction of a 4 story, 55 x 105 ft. addition to its shoe factory, also a 3 story, 47 x 71 ft. administration building on Laclede St. near Grand Blvd. Estimated cost $100,000.

Mo., St. Louis—A. B. Plows, 1010 North 10th St., is having plans prepared for the construction of a 3 story, 35 x 140 ft. factory for the manufacture of mattresses. Estimated cost $25,000. E. J. Lawler, 1028 Chemical Bldg., Archt.

N. J., Hammondton—The Littlefield Ice Co. awarded the contract for the construction of a 3 story ice and storage plant. Estimated cost $50,000.

N. Y., Jamestown — The Clarke Baking Co., 809 North Main St., plans to rebuild major portion of its bakery on Richmond Pl., which was recently destroyed by fire. Estimated cost $50,000. Architect not announced.

N. Y., Jamestown—The New Ice & Coal Co., 925 Clinton St., plans to build an ice manufacturing plant. Estimated cost $18,000. Architect not announced.

N. Y., Rochester—The Rochester Gas & Electric Corp., Clinton Ave., N., plans to build a complete new water gas plant, capacity, 4,000,000 to 5,000,000 cu.ft. per day, on Platt St. J. Haftnkamp, Supt.

N. Y., Rochester—The Rochester Packing & Cold Storage Co., 78 Front St., awarded the contract for remodeling and building an addition to its plant. Estimated cost $200,000.

N. Y., Sheepshead Bay (Brooklyn P. O.)—The Superior Ice Co., Inc., 50 East 42nd St., New York City, will soon award the contract for the construction of an ice plant on Ave. Z and East 17th St., here. Estimated cost $250,000. W. Mortensen, 209 West 76th St., New York City, Engrs. and Archts. Noted Oct. 5.

O., Akron—The General Tire & Rubber Co., 1708 East Market St., awarded the contract for the construction of a 1 and 3 story, 40 x 180 ft. and 60 x 100 ft. additions to its factory. Estimated cost $100,000. Noted Nov. 16.

O., Cleveland—The Richard W. Kaase Co., 2836 Lorain Ave., awarded the contract for the construction of a 2 story, 68 x 150 ft. bakery. Estimated cost $150,000. Noted June 1.

Okla., Ardmore—The Consumers Light and Power Co. plans to build a 6,000 ton cold storage house. Estimated cost $100,000.

Ore., Haines—The Commercial Creamery plans to rebuild its plant which was destroyed by fire. Estimated cost $75,000. A. H. Goodhue, Pres.

Pa., Johnstown — The Edward Hahn Packing Co., Hickory St. and Baltimore & Ohio R.R., is receiving bids for the construction of a 3 story, 48 x 108 ft. and 24 x 112 ft. addition to its packing plant. Estimated cost $65,000. Private plans.

Pa., Oakmont—The Valve Bag Co. of America, 3444 Summit Ave., Toledo, O., awarded the contract for the construction of a 2 story, 74 x 94 x 157 x 158 ft. addition to its paper bag factory. Noted Oct. 19.

Pa., Phila.—The Amer. Ice Co., 6th and Arch Sts., awarded the contract for the construction of an ice manufacturing plant on Duncannon and Mascher Sts. Noted Nov. 16.

Pa., Phila.—The National Biscuit Co., 10th Ave. and 15th St., New York City, awarded the contract for the construction of an 8 story, 150 x 257 ft. bakery on 12th and Glenwood Ave., here. Estimated cost $1,000,000.

Pa., Phila.—The Paper Mfg. Co., 562 Cherry St., awarded the contract for the construction of a 6 story, 120 x 180 ft. paper factory on 5th St. and Willows Ave. Noted Oct. 12.

Pa., Pittsburgh—The Auto Truck Equipment Co., 7511 Penn Ave., and A. G. Wickersham, Archt., 517 McClure Ave., Homestead, are receiving bids for the construction of a 1 story, 31 x 99 ft. auto trim and paint shop at 7505 Penn Ave.

Pa., Pittsburgh—The Crandall McKenzie Co., Jenkins Arcade, awarded the contract for the construction of a 2 story, 20 x 60 ft. addition to its dyeing plant at 7029 Chaucer St. Estimated cost $10,000.

Pa., Pittsburgh—The F. J. Kress Box Co., 2930 Liberty Ave., awarded the contract for the construction of a 3 story, 70 x 155 ft. addition to its box factory. Estimated cost $40,000. Noted Nov. 16.

Pa., Ridgway—Hyde Murphy Co. will build a 4 story, 60 x 90 ft. addition to its woodworking factory.

Pa., Tullytown — The Megargee Paper Mills, 16 South 6th St., Phila., plans to build a paper plant, here. Architect not selected.

R. I., Providence—The Crompton & Knowles Loom Wks., 93 Grand St., Worcester, Mass., will soon award the contract for the construction of a 2 story, 50 x 170 ft. addition to its plant on Harris Ave., here. Estimated cost $60,000. Private plans.

Tex., Dallas—E. M. Thomas, c/o Trinity Constr. Co., S. W. Life Bldg., will receive bids until January 1, for the construction of a 2 story, 75 x 140 ft. ice cream cone factory at 2220-22 South Harwood St., for the Consolidated Wafer Co., 2426 South Harwood St. Estimated cost $10,000. L. D. Pape, Secy. and Mgr.

Tex., McKinney—The Texas Cotton Mills Co. plans to double capacity of present textile mill and industrial housing. Estimated cost $750,000. Engineer not selected.

W. Va., Charleston—The Evans Lead Co., Essex Fells, N. J., awarded the contract for the construction of a 1 story, 50 x 180 ft. and a 4 story, 50 x 180 ft. plant for the manufacture of lead products, here.

W. Va., Clarksburg—The Clarksburg Ice & Storage Co. will build a 1 story, 50 x 120 ft. ice plant. Estimated cost $50,000. Noted Oct. 12.

W. Va., Huntington—The Nightrack Mfg. Co. awarded the contract for the construction of a 2 story, 40 x 120 ft. woodworking factory. Estimated cost $25,000. Noted Nov. 23.

W. Va., Logan—The Logan Ice Co. is having plans prepared for remodeling and building a 22 x 100 ft. addition to its ice plant. A. C. Bishop, 427 Guardian Bldg., Cleveland, O., Engr.

W. Va., Princeton—The Princeton Hosiery Mills Co. will build a 2 story, 48 x 118 ft. hosiery mill. Estimated cost $25,000. Noted Oct. 26.

W. Va., Shinnston—The Alley Glass Co. will soon receive bids for the construction of a glass factory. Estimated cost $250,000. L. Alley, Pres. Architect not announced.

Wis., Denmark—The Danish Pride Milk Co., 608 North 8th St., Sheboygan, plans to build a 2 story condensery and milk factory, here. Estimated cost $60,000. Architect not selected.

Wis., Milwaukee — The Federal Rug Cleaning Co., 914 Winnebago St., awarded the contract for the construction of a 2 story, 50 x 60 ft. addition to its factory. Estimated cost $20,000. Noted Nov. 23.

Wis., Milwaukee—The Wisconsin Ice & Coal Co., 216 West Water St., awarded the contract for the construction of a 1 story, 114 x 120 ft. ice manufacturing plant on 31st and Galena Sts. Estimated cost $60,000.

Wis., New London—The Wisconsin Cabinet & Panel Co. will build a 2 story, 72 x 112 ft. box factory. Estimated cost $60,000. J. H. McLaughlin, Mgr.

Wis., Sheboygan—The Vollrath Co., West Michigan Ave., awarded the contract for the construction of a 2 story, 180 x 200 ft. enameling factory, including annealing and stamping room. Estimated cost $55,000. D. F. Riess, Secy.

B. C., Vancouver—Cranes Shipyard, Ltd., North Vancouver, plans to build marine ways and repair plant on Georgia and Denman Sts. Estimated cost $40,000.

Ont., Niagara Falls—The Welland Packing Co., Ltd., Welland, awarded the contract for the construction of a packing and canning factory along the tracks of the Michigan Central R.R., here. Estimated cost $44,000.

Que., Hull—The Lion Meade Tire Co. awarded the contract for the construction of a 2 story factory at Wrightville. Estimated cost $75,000.

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Repairing Locomotives in a Milwaukee Shop

Modern Production Methods Applied in a Locomotive Repair Shop—Uses of the Electric Welding Machine and Gas Torch—Time-Saving Devices

BY HOWARD CAMPBELL
Western Editor, *American Machinist*

ALTHOUGH railroad repair shops as a rule are not noted for their modern methods, the West Milwaukee shops of the Chicago, Milwaukee and St. Paul Railway are keeping up with the times both as to methods of production and in handling the work. Material is ordered and delivered in a systematic manner, and

FIG. 1—WELDING SMOKE-BOX RING INTO FIRE-BOX

the old idea of setting up a machine where there was the most space has been discarded for the modern system of grouping. All the machines that are necessary for the machining of any of the major parts are arranged so that the operations can be performed in sequence.

Instead of the machinist or his helper going to the stock room for material, he simply notifies the foreman. The latter makes out an order and drops it into a box attached to his desk. A stock-boy collects these orders every half-hour and within the next half-hour the material is delivered to the machine by a laborer from the stock room.

Another interesting feature of this shop is that the customary method of having parts forged in the blacksmith shop is being largely discarded. Patterns have been made for most of the parts that comprise the link motion and steel castings for these parts are now kept in stock. As the castings are made exactly to size where no machining is required, the expensive forging operation and a great deal of unnecessary machining is saved.

Another saving, and certainly a most sensible one, is assured in the making of drive-bolts. These are turned out of round bar stock, the material being of sufficient diameter to leave a head of the desired size. The stock is much cheaper and the round head, for this purpose, is just as efficient as a hex or square head. If the bolt is loose enough, so that a wrench would have to be used to hold it from turning, it is too loose to use in a place where a drive fit is required. These bolts are used in all places where drive fits are necessary.

Many of the parts that formerly were riveted are now spot-welded together, an electric arc-welding machine being used for this purpose. In Fig. 1 is shown the operation of welding the smoke-box ring into

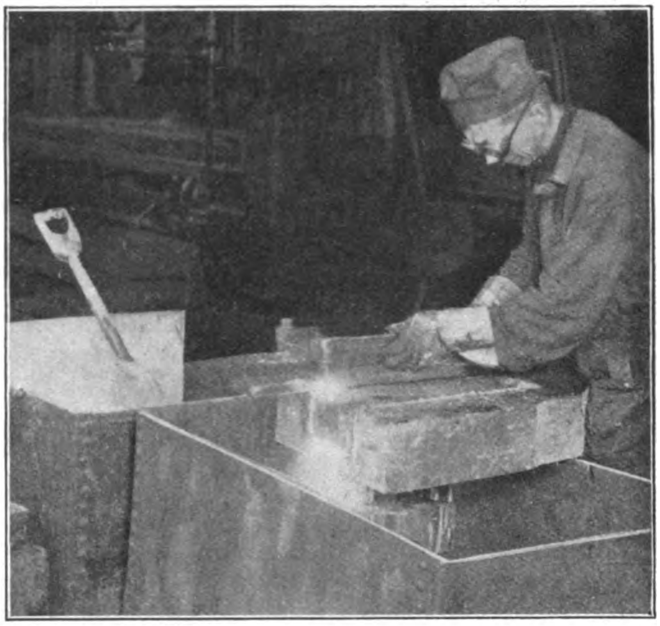


FIG. 2—BLANKING OUT MAIN ROD WITH GAS TORCH

the front end of a locomotive fire-box. The machine is a Burke Electric Arc-Welding machine, using a current up to a maximum of 200 amperes at 50 volts. The seam is welded both inside and outside, a ¼-in. iron wire being used to make the weld. This makes a much smoother looking job than the old method of riveting and saves the time of drilling the holes and heading the rivets. The time required for riveting in a smoke-box ring was approximately five hours and required the time of four men. One man can easily weld a ring in alone, doing the job in six hours. Door-sheets and flue-

sheets are also welded in instead of being riveted, saving 50 per cent of the time formerly required to assemble these parts. The hopper is welded into the ashpan, using an arc-welding machine made by the C. & C. Elec. Mfg. Co. The current is transformed down from 220 volts to 45 volts, 600 amperes. Scrap strips of boiler plate are used for the welding material. It once

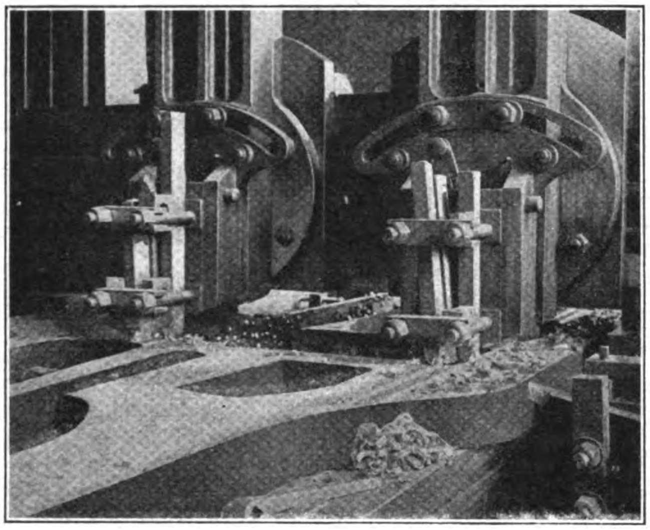


FIG. 3—USING MULTIPLE TOOLS ON PLANER

required from 15 to 18 hours to rivet a hopper in place but now the welding operation takes approximately three hours.

The acetylene gas torch also has its place in this shop. The operator, shown in Fig. 2, is cutting out or "blanking out" the end of a main rod, using a gas

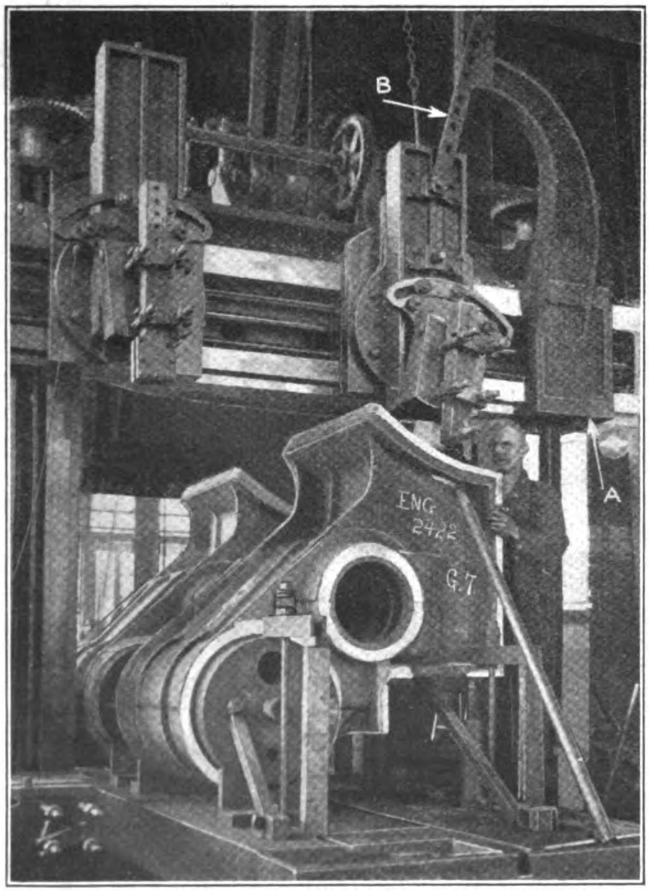


FIG. 4—PLANING RADIUS ON CYLINDER CASTINGS

torch with a cutting tip. The rod is laid out and two holes are drilled at the inner corners of the block. these holes forming the radius necessary in the corners. The rod shown in the illustration is $5\frac{1}{2}$ in. thick and the average time required to cut out the block is 15 minutes. This operation used to take five hours on the slotter. The finishing operation is done on the slotting machine and takes the same amount of time as before, about $3\frac{1}{2}$ hours. Immediately after the block is cut out, and while the rod is still hot, the rod is thrown into the box just the other side of the operator and the hot ends are covered with asbestos, so as to prevent oxidation and the resultant hardness.

That this shop is keeping up with modern ideas of production is evidenced by the use of multiple tools on the planer shown in Fig. 3. The operation is that of planing the side of a locomotive frame. Eight tools are in operation simultaneously, one on each upright of the planer and three in each of the heads on the cross-rail.

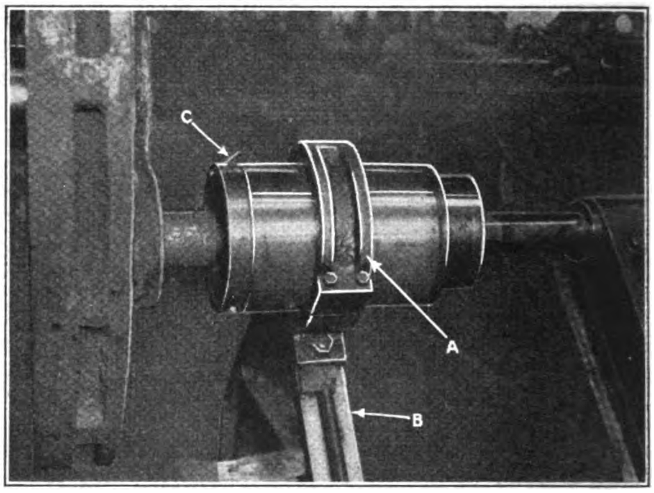


FIG. 5—CRANK-PIN TURNING ATTACHMENT

Two of the three tools are set in tandem, each tool taking half of the roughing cut. The third tool is a finishing tool.

Another interesting planer job is shown in Fig. 4. Here the operation of planing the radius on a cylinder casting is shown, using an attachment by which the desired radius is cut as the head feeds across the machine. The arm *A*, which is of cast steel, is attached to the cross rail and the strap *B* is attached to it and to the toolslide as shown. As the cut proceeds across the piece, the strap swings on the bolts and the slide is gradually raised, describing an arc as it does so and cutting the desired radius on the casting. This saves the work of feeding the tool up by hand and makes a practically perfect job. The radius can be cut on a pair of these castings set up in tandem as shown in nine hours. This operation used to be done by hand chipping, which took 40 hours, and later by using an air hammer and chisel, which took 20 hours.

Another tool that saves a great deal of time and labor is the crank-pin turning attachment shown in Fig. 5. The attachment consists of a steel sleeve 12 inches in diameter and $\frac{3}{4}$ in. through the wall, attached by means of machine screws to a head on which a shank is turned. The shank fits into the spindle-sleeve of a quartering machine. The sleeve turns in the journal *A* which is attached to the support *B*. The tool, shown at *C*, is of $\frac{1}{2}$-in. high speed steel. The tool has to be set to turn the pin to the desired diameter. As the work

has just been changed, the tool shown in the illustration is not set for the pin shown. When the machine is in operation, the sleeve feeds along at the rate of $\frac{1}{32}$ in. per revolution, turning at a rate of 12 r.p.m. The use of this attachment eliminates the necessity for pulling out the pin in order to turn it in a lathe as was formerly done.

A set-up for milling the flutes in spiral reamers and milling cutters is shown in Fig. 6. After a series of experiments, it was found that the best results were obtained by using reamers and cutters with left-hand spiral flutes. The reamers produce nice holes and practically never stick in the work, something that cannot be said of straight reamers nor of those with a very gradual twist. Large "bites" are impossible. The largest reamer, *A*, is a frame reamer, used for reaming the frame splice. The next tool, *B*, is a cutter used for milling the jaws in the side rod, as shown in Fig. 7. The third one, *C*, is for milling the keyway in the piston rod, and the fourth, *D*, is a standard taper pin reamer.

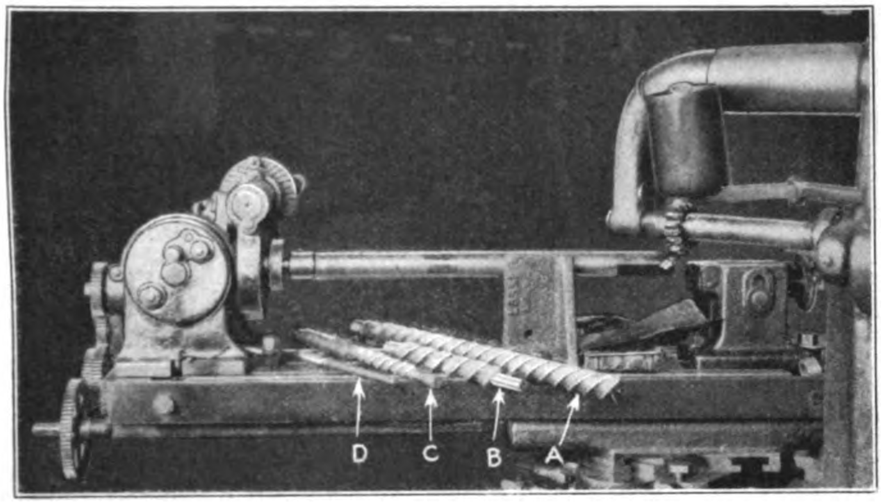


FIG. 6—MILLING FLUTES IN SPIRAL CUTTERS

The cutter used for milling the fork end of the side rod, as shown in Fig. 7, is eight inches long and 1¼ in. in diameter. The cutter feeds in on the top of the slot and out on the bottom, making a smooth job. The time is 2½ hours as compared to the old time of 3½ hours on the slotting machine. An application of a universal joint to a reamer is shown in Fig. 8. The joint is so simple that no explanation is necessary. By using this, the necessity for perfect alignment of the work with the spindle is eliminated, thereby saving a considerable amount of time. The job shown is that of reaming out the bearing hole in a link-cheek.

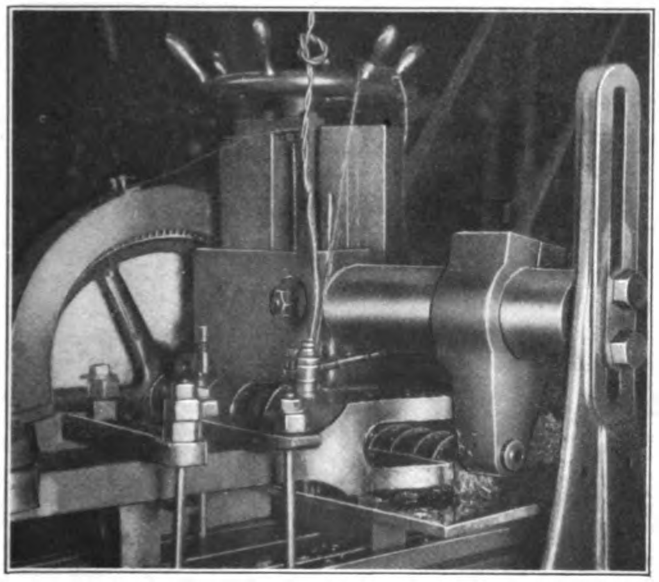


FIG. 7—MILLING FORK END OF SIDE ROD

A jig for drilling the holes in a jet nozzle for a standard stoker is shown in Fig. 9. The piece is locked into the box *A*, which swings on pins, one on each end. Plate *B* contains a bushing through which nine $\frac{3}{16}$-in. holes are drilled, one at a time. Each hole is located by the use of the spring-pin *C*, which slips into each of a series of holes in the end of the box, as it is swung around.

After these holes are drilled, pin *C* is pulled out and locked and spring-pin *D* is slipped into a hole, holding the box central while three holes are drilled through the plate *E*, and three more through a similar plate on the other side of the jig. After this the jig is turned bottom up and pin *D* is slipped into a hole which brings the two holes *F* in line with a pair of bushings in the bottom of the jig. The jig is shown in this position in the photograph, although it hasn't been turned over. The amount of time saved over the time required for laying out this casting is obvious.

A jig for drilling the one hole in a split valve packing-ring is shown in Fig. 10. The old method of making these rings was to turn them, drill them, and then split them. They had to be laid out for drilling. Now they are turned, split, and then drilled, saving the laying out time. One end of the ring is held firmly by the clamp *A* and the other end is locked into block *B*. The knurled screw *C* passes through a hole in block *B* and screws into a swivel nut attached to the plate to which the clamps are attached. By turning screw *C*, the ends of the ring are brought together and clamp *D* is applied. Then the hole is drilled through the bushing shown just under the point of the drill.

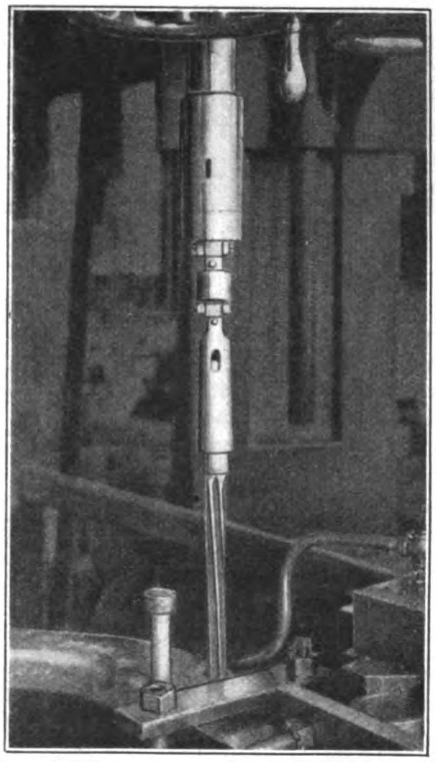


FIG. 8—UNIVERSAL JOINT ON A REAMER

The machine shown in Fig. 11 was built in the shop tool room, and is used for milling the ports in slide-

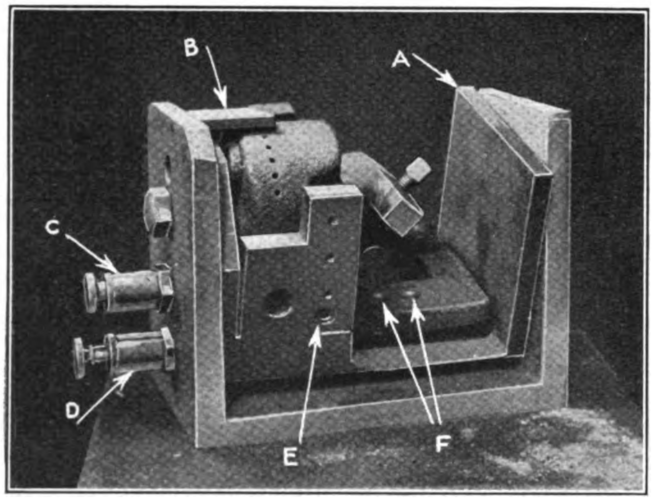


FIG. 9—DRILL JIG FOR JET-NOZZLE

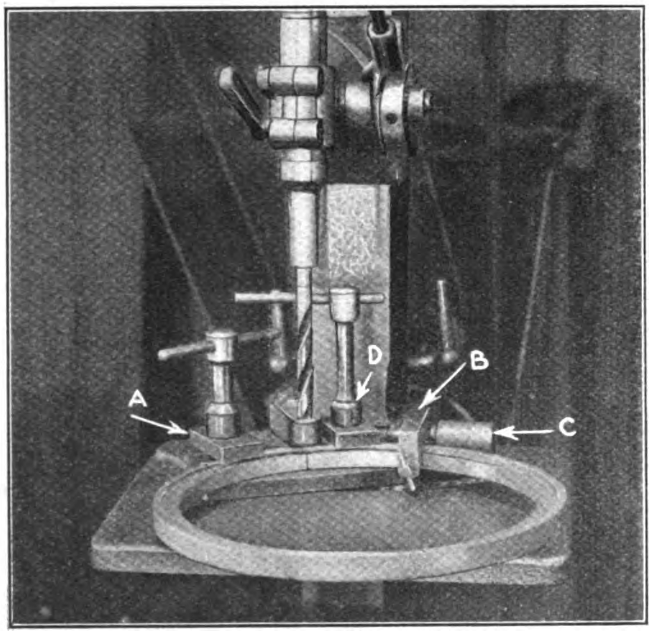


FIG. 10—DRILLING A SPLIT VALVE PACKING-RING

valve cylinders. Little description is necessary as the operation of the machine can be determined by studying the photograph. The cross-rail is bolted to the two angle plates *A*, and to the bottom of each plate is attached a nut in which the screws *B* turn. The handle *C* turns a shaft on which are two bevel gears that mesh with similar gears on the ends of the screws, making it possible to feed the mechanism across the work.

The vertical feed-rod and cross-feed screw operate the same as on any cross-rail. Without this machine, it would be necessary to chip the clearance by hand or air-hammer, then put the cylinder onto a planer and finish the ports, a very tedious operation. This method used to take approximately six hours, while by using the machine shown, the job can be done in two hours, a worth-while saving.

The home-made link-grinding machine shown in Fig. 12 is used for grinding the radius on the inner surfaces of a link. The wheel, shown at *A*, is 2¼ in. in diameter and 3½ in. long when it is new. The link is held in place by the clamping action of the two bolts *B* through the carriage *C*. The carriage is made of two parallel pieces held together by shafts through either end, these shafts also serving as axles for the four wheels on which the carriage rides. The wheels are V-shaped to fit into the grooves in the ways *D*. The handle *F* is used to

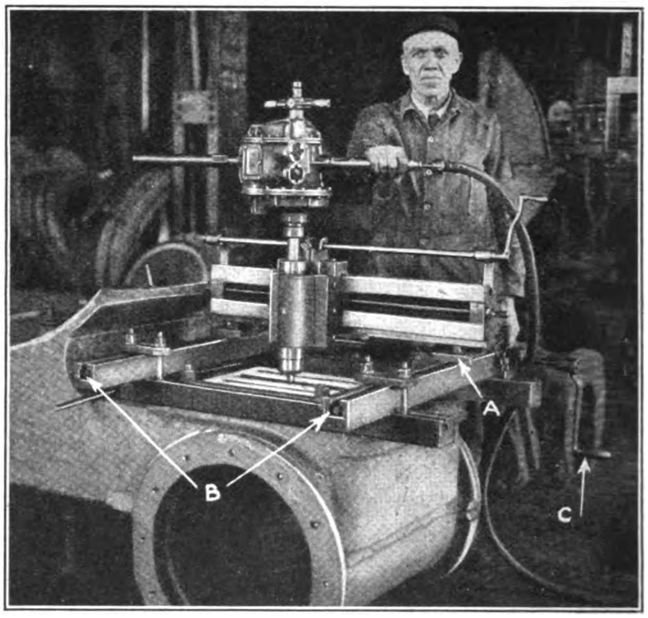


FIG. 11—MILLING PORTS IN SLIDE-VALVE CYLINDERS

feed the carriage past the wheel. The wheel is attached to a slide which can be adjusted for height by turning the handle *G*, attached to an adjusting screw. Although the ways are perfectly straight, the carriage describes an arc as it rides back and forth on the ways, the radius of the arc being determined by raising and lowering the ways by means of the screws *E*. The ways are attached to a large plate *H* that can be adjusted so that the wheel will be worn evenly.

The link shown in the photograph is of the hand-

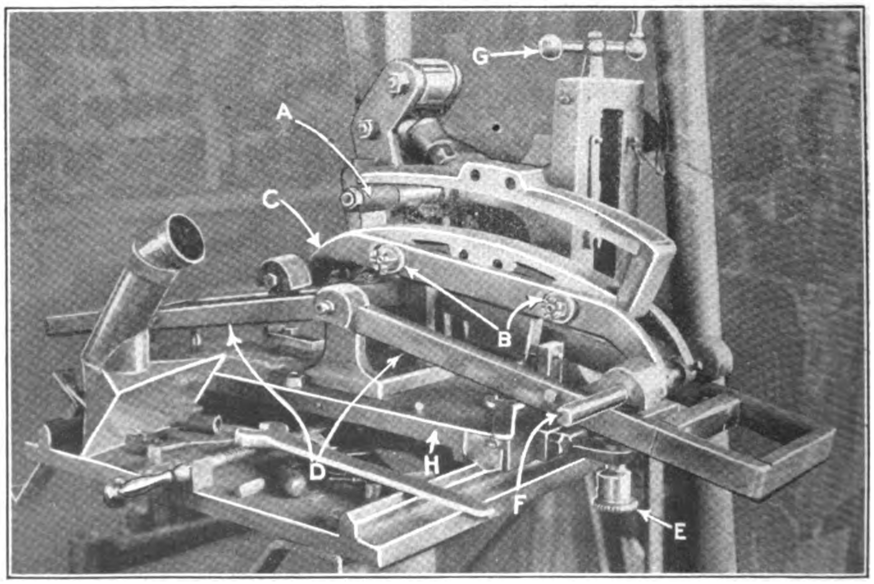


FIG. 12—"HOME-MADE" LINK GRINDING MACHINE

forged type which has been discarded for those of cast steel. Spring steel plates $\frac{3}{8}$ in. thick, made from old locomotive springs, are welded onto the radial surfaces of the cast steel links, and are then ground to the desired radius. When these plates are worn down to the limit, they are replaced. Thus the links are saved, the scrap spring-leaves are made use of, and the time of electric-welding a pair of spring-plates into a link is small compared with the time required for forging a new link.

The mechanism shown in Fig. 13 is a device for pressing cylinder bushings into place, and is counted one of the most valuable labor-saving tools in the shop. It consists of an ordinary air drill, the spindle of which drives a set of compound gearing enclosed in the housing *A*. The hub of the fourth, or driving gear, contains a nut that is threaded to fit a square thread on the screw B. This screw is $2\frac{3}{8}$ in. in diameter and extends through the cylinder, and through a brace and nut on the other end. A ball-bearing thrust washer is placed between the nut which does the pulling and the hub of the plate *C*, to take the wear and facilitates the operation. When the air is applied, the gears turn and the nut threads itself onto the screw, driving plate *C* before it and pressing the bushing *D* into the cylinder.

The older and more usual method of doing this job is to heat the cylinder until it expands until the bushing can be pressed or driven in by hand. This, however,

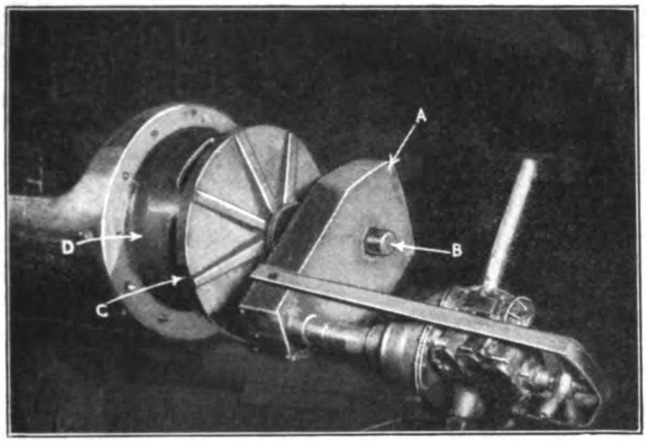


FIG. 13—PRESSING-IN A CYLINDER BUSHING

is very hard work and the time required for the heating alone is approximately three hours, whereas, with the devices shown here the job can be done in 45 minutes. Heating the cylinder also sets up stresses in the metal which sometimes prove disastrous. The strength of the mechanism is evident from the fact that it has pulled 150 tons in a test.

Time is also saved by the method of fitting the bushing to the cylinder. Instead of boring the cylinder straight, the left, or last half is bored $\frac{1}{16}$ in. smaller than the right, or first half and the bushing is turned to fit it accordingly, leaving the usual amount on each diameter for a press fit. This makes it possible to insert the bushing half-way into the cylinder before power has to be applied, yet the bushing fits just as tightly as though it were all one diameter.

The operation of milling the ports in a valve bushing is shown in Fig. 14, using a Milwaukee No. 3 milling machine and a rotary attachment that is supplied by the manufacturer of the machine. The table of the machine is adjusted so that the cutter is central with the rotary table, then the feed mechanism is applied,

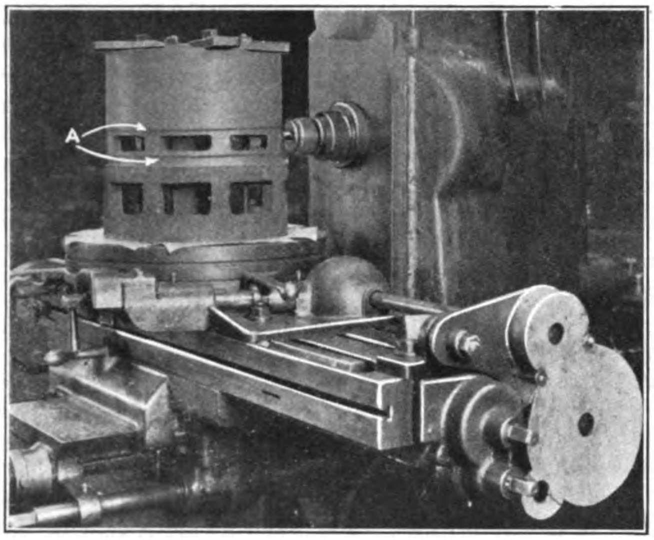


FIG. 14—MILLING PORTS IN A VALVE BUSHING

through a train of gears, to a worm and wheel on the under side of the rotary table. The two lines *A* are the operator's layout lines. After laying out the casting, the table is fed in until the cutter is through the wall of the casting, then the rotary feed is applied. The top edges of all the holes are milled first, then the bottoms. A gage is used by the operator to be sure that every port is of the correct size and shape.

Grinding and Other Practices in Motor Building

By Frank C. Hudson

There is a general tendency toward making motors and other parts of motor cars so they will be longer lived. Bearings are being better fitted, with due allowance for the oil film for lubrication, and piston pins are being carefully considered. The use of aluminum alloy pistons introduced a new problem in the way of increased expansion in the piston itself as the motor warms up. Where the piston pin is held in the connecting rod it is necessary to have the pin fit the piston very closely, when cold. One builder heats his pistons in hot water before putting the pins in place, thus expanding the pistons so the pins will slip in more easily.

Long service between repairs demands that both the holes and the pins be round, which also applies to the bushings used in some connecting rods when they do not carry the pins. In most cases the holes in pistons are finished by reaming, although some are ground and a few makers have tried broaching. Piston pins are ground without an exception so far as we know, but the grinding practice differs materially from shop to shop.

Piston pins are made in two ways, from steel tubing and from bar stock, and in the latter case the drilling is usually divided into two or three operations. There seems to be a feeling that the steel runs more uniformly in bars than in tubing, and that pins of more uniform hardness can be secured if made from a bar. The holes are usually countersunk to fit a 60-degree center for grinding between centers. In all cases the ends of the pins are either chamfered or the corners rounded. In a few cases the holes in the pins are rough ground, but this is unusual. The general practice is to grind the countersinks to insure a perfect seat for the centers in

grinding the outside, though where the pins are ground on the centerless type of machine, this is unnecessary.

Ever since the centerless grinding machine came into use there have been many questions as to its ability to grind pins round and straight. Time and experience have proved that both are possible on a good machine, properly handled. But here again practice varies widely. Some makers advocate the centerless machine for rough grinding, leaving the finishing to be done between centers. Others, and among them some who are very exacting as to requirements, reverse this process and rough grind between centers, finishing on a centerless machine.

Moreover, they get a splendid job, both as to roundness, straightness and finish, and at a rate of from 12 to 15 a minute. This production could be increased except for the fact that the pins are not allowed to fall into a chute or box but each one is picked out to be sure it is not marred in any way. By this method, with the 0.02 in. left for the finish grind, they secure a beautiful surface which does not require lapping and pins which test round on a Prestwich or other supersensitive gage.

Experience indicates that the centerless grinding machine will produce round work if the pins are round to begin with, while there are some who contend it will perfect pins that are not round. Steering pins, bushings, rollers and the like are being ground in large quantities on centerless machines, the continuous process evidently appealing to production managers. In some cases parts are being redesigned so that they can be finished on the centerless machines. For, while parts with collars can be ground without centers, the advantage of continuous feeding is lost and in many cases it has been found advantageous to omit collars and other protuberances.

The finishing of bushings for the small ends of connecting rods where the piston pins either float or are held in the pistons, is another operation that is performed in various ways. Some bushings are broached, some bored with a single point tool (a diamond in a few instances), some ground and many reamed. The final finishing takes place after the bushings have been pressed into the rods. One builder grinds the bushings after they have been put in place, swinging the connecting rods on a face plate which locates them by the large end. This method insures the holes being at the correct center distance and in alignment with each other. But the hole is not ground to size, as the surface left by the wheel is not just what this particular maker desires. So 0.002 in. is left for finish by reaming. It is contended by some makers that while the ground surface may not appear to be as smooth because of its lack of polish, that in reality it provides a good bearing surface. And further, that if there are any indentations due to the grinding wheel, they are extremely small and serve only as tiny oil pockets.

The bearings at the large ends of connecting rods and the main or line bearings in the crankcase are a different story. Here as with piston pins, there seems to be a leaning toward selective assembly with regard to the high and low limits. The bearings are either selected to give the proper fit on the crankshaft or else they are reamed to fit the shaft by Martell or some similar system. Scraping has been abandoned by nearly all motor builders, as the general opinion seems to be that a reamed bearing is best when properly done.

The "burning-in" of bearings is practiced in a few large production plants and when well done is very satisfactory. The bearings are pinched tight on the shafts and the shafts run until the bearing metal softens enough to conform to them in every particular. The "running-in" of bearings is an entirely different matter and should not be confused with burning-in. Running-in is in reality nothing but a limbering up of the bearings to insure enough space between them and the pins or shafts, for a sufficient supply of lubricant. The methods used vary from running the engine by an electric motor with rods in place and thoroughly lubricated —to running the rods in on a dummy shaft which represents the crank pins. The objection to the latter method seems to be that the crankpin is assumed to be exactly the same size as the dummy shaft, which can hardly be the case. Some builders give every motor a running test under its own power for a given length of time and a few go so far as to tear the motors down and, after careful examination, reassemble them for a short final test and assembly in the chassis.

Report on Gage Steel

The Gage Steel Committee of the Bureau of Standards report that satisfactory progress has been made in the study of the wear of "Ketos" steel. This steel, as hardened, has been worn against itself and against hardened disks tempered at 150, 200, 250, 300 and 400 deg. C. (302, 392, 482, 572 and 752 deg. F.). The results obtained to date indicate that, under the very special conditions of testing used, the steel is increasingly resistant to wear with increasing tempering temperatures up to about 300 deg. C. (572 deg. F.). With higher tempering temperatures the wear resistance decreases. Tests of this steel hardened and tempered at several other temperatures are now in progress.

A few preliminary experiments on a steel which has no hardening transformation in the heat treating range, showed that a scale several thousandths of an inch thick forms on heating to 800 deg. C. (1,472 deg. F.) in an electric furnace with access of air. To obviate oxidation, 4-in. cylinders of this steel were heated in an electric furnace in which illuminating gas was burning and quenched in water. One, previously silver plated, was free from scale and showed a shrinkage of about 0.0001 in. in length and diameter. The other, unprotected, increased 0.0002 in. in length and 0.0003 in. in diameter and a thin scale formed. The difference between the two is evidently the thickness of the scale formed probably on transference from furnace to bath. Assuming that the difference between the change in diameter at the center and at the end is a measure of distortion, there is no indication of distortion on water quenching. Appreciable distortion must then occur with the hardening transformation.

High carbon steels having a hardening transformation during quenching, flake off their scale and this leaves the surface clean. To estimate the thickness of the surface layer so lost, a specimen of 1.10 per cent carbon steel was oxidized in an electric furnace with free access of air and found to lose 0.057 grams (0.88 grains) on removal of the scale. This is equivalent to a surface layer of iron about 0.0002 in. thick. It seems probable, therefore, that if precautions are taken to prevent oxidation in the furnace, scaling will not lead to serious error. Experiments are now under way to study the distortion accompanying the hardening transformation in chrome steel, taking the obvious precautions noted above.

Infection from Cutting Oil

Used Screw Machine Oil a First-Class Germicide—Results of a Careful Laboratory Test on Cutting Oils—Soda Solution a Remedy

By A. L. De Leeuw
Consulting Editor, *American Machinist*

AN ARTICLE in the *American Machinist* of September 21st, 1922 by Gus Haessler tells of the benefits derived from the sterilization of cutting oil. The article winds up with the following sentence: "Sterilization attacks the problem at its root and oil systems that do not include this process should be regarded as hardly in step with modern sanitary engineering practice." The following remarks are not for the purpose of minimizing the value of sterilization but of putting before the users of cutting oil, which means before the management of practically all machine shops, the facts obtained by an investigation of the troubles resulting from the use of such oils.

At one time, the Singer Manufacturing Company was confronted with these troubles. Many men in the screw machine department and in other departments, where cutting oil was used, suffered from infection which sometimes resulted in sores on the arms or other parts of the body, in some cases causing nausea and other internal troubles and occasionally both. The writer among others was firmly convinced that sterilization was necessary and that it would probably solve the problem. In order to find out how to proceed with the greatest possible amount of assurance, the Lederle Laboratories were asked to make tests of oil, new and used, with and without sterilization and to suggest means of obtaining the best possible results. Three reports were received from the laboratories and one is printed here in full, with the kind permission of the Singer Manufacturing Company.

LEDERLE LABORATORIES
SANITARY, CHEMICAL AND BACTERIOLOGICAL INVESTIGATIONS

39-41 West 38th Street
New York City

SECOND
REPORT

In the Matter of a Series of Bactericidal Tests of Two Samples of Lubricating oil marked "Lard Cutting Oil as Received, 1" and "Lard Cutting Oil after Use, but not filtered, 2." Received from the Singer Manufacturing Company, about April 19, 1916.

TECHNIQUE

Test organism: In all of the tests here reported Staphylococcus pyogenes aureus, grown in beef extract broth for 24 hours at a temperature of 37 deg. C., was the organism against which the germicidal efficiency of the oil was tested.

Environmental factors: Before the beginning of the test the portions of oil which were to be tested were raised in temperature to 37 deg. C., by the expedient of placing them in a body heat incubator for a sufficient length of time.

The operation which marked the beginning of each test consisted in removing the oil from the incubator and inoculating each portion with two-tenths of a cubic centimeter of the 24 hour, 37 deg. C., broth culture of Staphylococcus aureus, which had been filtered to remove clumps; and immediately returning the portions of oil to the incubator. In this manner the temperature environment was maintained and the efficiency of the tested materials measured at a given point.

The amount of each tested portion was twenty cubic centimeters, contained in a one-ounce, glass stoppered bottle which had been sterilized prior to use.

In each of the first five tests the two controls which were included consisted of sterile distilled water and, in one of these, 0.5 per cent sodium chloride had been added before sterilization. In each case, the amount was twenty cubic centimeters.

Procedure Followed in Making the Various Tests

In test No. 1 the oils were tested without in any way altering them.

In test No. 2 the oils were tested after heating, at 100 deg. C., in flowing steam, one time for thirty minutes. This was done by transferring 50 c.c. or more from each of the samples to a small flask and sterilizing it in that container.

In test No. 3 the oils were heated at 100 deg. C., in flowing steam, two times for thirty minutes each time, before testing.

In test No. 4 the oils were heated at 100 deg. C., in flowing steam, three times for thirty minutes each time, before testing.

In test No. 5 the oils which had been heated at 100 deg. C., in flowing steam once only, were again heated in superheated steam under a pressure of 20 lb. for twenty minutes before testing.

In test No. 6, oil No. 2 was omitted. Oil No. 1 was treated in two different manners to make it germicidal, and was used, untreated, as a control. The treatment of one portion consisted in heating it, in a porcelain casserole, over a free flame for 10 minutes. The treatment of the other portion consisted in adding to it Merck's Xylenol, B. P. 200 deg.—215 deg. C., in the proportion of 1:1000.

In test No. 7 No. 1 oil was heated in a sand bath over a free flame for one hour and forty-five minutes, thereby charring and reducing it in volume to a noticeable extent. Number 1 oil, untreated, was used as a control.

Oil number 2 is a sample of the used but unfiltered oil. The results above reported show it to possess rather marked germicidal properties (Test No. 1) which were not in any way reduced by the subsequent heatings (Tests Nos. 2 to 5 inclusive). In view of the fact that the used oil becomes heated during use, attempts were made to determine whether heating of the fresh new oil would also bestow upon it germicidal powers. Apparently heating does produce such a change, but the amount of heat is upwards of 125 deg. Centigrade. As yet no efforts have been made to

determine definitely the point at which this property is produced, it being the present object to indicate in a qualitative manner that the heating was capable of developing the germicidal property in the oil.

The germicidal property in the used oil, No. 2, is far superior to that produced by the addition to new oil No. 1, of one part to one thousand of Xylenol, although the latter has ten times the germicidal strength of phenol when tested in appropriately constructed emulsions.

It would appear that the course to be pursued in the prevention of the transmission of disease producing bacteria from worker to worker by the new oil, would be to thoroughly mix the new oil which is customarily added to the used oil, and to do so before filtering and heating rather than afterwards. In this way the new oil would be subjected to both the germicidal action of the used oil and to the heating process, which later may tend to produce germicidal qualities in the new product.

These results would tend to indicate that the skin disease among some of the workers was not due directly to the transmission of infectious bacteria by the oil. A plausible working hypothesis is that the change made in some constituent of the oil by heating develops not only some germicidal property in it, but also some skin irritating substance or quality. It is altogether possible that this newly developed substance or property is also the cause of the symptoms of weakness and nausea of which some of the workers complain.

Respectfully submitted,

H. D. PEASE

Director, Dept. of Bacteriology Lederle Laboratories

F. D. BELL

Secretary

To: THE SINGER MANUFACTURING CO.

Elizabethport, New Jersey

This report shows not only that used oil has no more bacteria than new oil but that it doesn't have any at all and also that the used oil is so strong and effective a germicide that it is recommended to mix the new oil with some of the old if danger of infection is feared. The results were so completely at variance with what the writer had expected that nothing but a detailed scientific report would have convinced him and he can well understand that many others will require such positive proof before they can be convinced. It is for this reason that the report is printed in full.

REMEDIAL EFFECT OF SODA SOLUTION

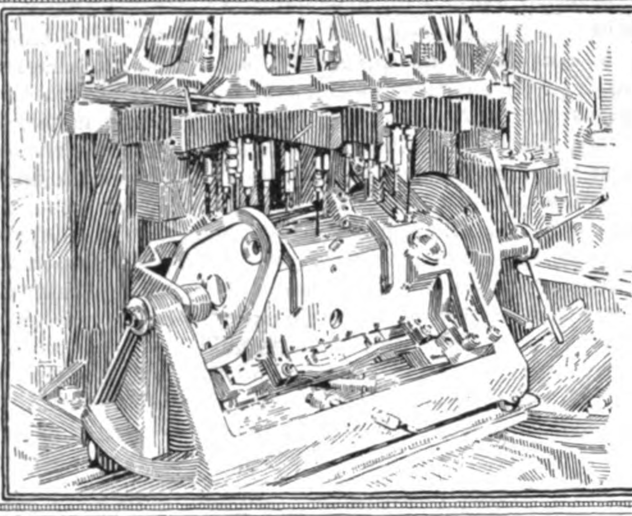
This report was turned over to the shop physician who based his future action on a fact which had not been noticed heretofore but which was now observed, namely that the men who washed the screw machine products in the soda kettle never had sores on the forearms which were bare or on any other part of the body which was occasionally spattered with the soda solution but that their skin would be affected on those parts which were covered and where the clothing might be partly saturated with oil.

As a result of this observation, the doctor advised the men to wash themselves several times a day in a fairly strong soda solution. In addition he gave them some internal medicine and this treatment overcame the difficulty completely. It is to be regretted that the shop physician did not try the two treatments separately in order to find out which was the really efficient one. The fact, however, that the washers were free from trouble on those parts of the body which came in contact with the soda solution would prove to the writer that it is the soda solution which is the effective remedy. Whether the trouble comes from the free fatty acids or from the very fine chips which may get in the pores of the skin or perhaps from some aldehyde which is formed in the oil is not known.

The foregoing is not an argument against sterilization of oil though the report shows that sterilizing at 100 deg. C. (212 deg. F.) is not sufficient and that sterilization does not take place until a temperature of 125 deg. C. (257 deg. F.) is used. It does point out, however, that sterilization does not eliminate bacteria, because there are none to eliminate. If oil is sterilized at all, it should be sterilized when new. It was also found at the plant of the Singer Manufacturing Co., that sterilization alone did not remove the trouble, but that washing in alkaline solutions did.

LABORATORY TESTS ON CUTTING OILS

Materials tested	Number of organisms surviving after indicated intervals of exposure: 6 hours	24 hours
TEST NO. 1 — Oils not treated in any manner, but inoculated with Staphylococcus aureus		
Oil No. 1	36,000	1,200,000
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	2,630,000	770,000
Aq. dest	2,720,000	660,000
TEST NO. 2 — Oils sterilized at 100 deg. C., 1 x 30 minutes and inoculated with Staphylococcus aureus		
Oil No. 1	4,385,00	2,070,000
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	2,670,000	1,315,000
Aq. dest	2,735,000	270,000
TEST NO. 3 — Oils sterilized at 100 deg. C., 2 x 30 minutes and inoculated with Staphylococcus aureus		
Oil No. 1	2,110,000	0
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	990,000	950,000
Aq. dest	1,145,000	100,000
TEST NO. 4 — Oils sterilized at 100 deg. C., 3 x 30 minutes and inoculated with Staphylococcus aureus		
Oil No. 1	3,955,000	1,865
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	10,000,000	6,315,000
Aq. dest	8,000,000	26,500
TEST NO. 5 — Oils sterilized at 100 deg. C., 1 x 30 minutes + autoclaving at 20 lb., 20 minutes, and inoculated with Staphylococcus aureus		
Oil No. 1	700,000	20
Oil No. 2	0	0
Aq. dest. + 0.5% NaCl	6,400,000	4,080,000
Aq. dest	6,200,000	3,825,000
TEST NO. 6 — Oil No. 1 heated over free flame 10 minutes; Oil No. 1 with Xylenol added in proportion of 1:1,000; Oil No. 1 untreated, and all inoculated with Staphylococcus aureus.		
Oil No. 1 heated over flame	1,890	0
Oil No. 1 with Xylenol	3,315,000	590,000
Oil No. 1 untreated	3,300,000	1,770,000
TEST NO. 7 — Oil No. 1, heated in sand bath 1 hour, 45 minutes; Oil No. 1, untreated, and both inoculated with Staphylococcus aureus.		
Oil No. 1 heated in sand bath over free flame	0	0
Oil No. 1 untreated	6,000,000	1,295,000



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Bending Dies for Producing Circular Work—Methods of Forming Bushings—Curling Beaded Work and Similar Parts—Plain and Progressive Bending Operations

WHEN a piece of work is to be formed in a circle there are many ways in which the operation can be done. It requires more than one operation to complete a circular piece, although it is possible to combine operations in such a way that one part will be produced at each stroke of the press. A very ingenious die has been recently designed for producing bushings. The development is interesting and somewhat different from the average run of die practice. The work shown at *A* in Fig. 478 is a bronze bushing which was previously made from a casting. The operations required in the old method were turning the outside diameter, facing the ends and reaming the hole, allowing sufficient stock for line reaming after assembling. A chamfer such as shown at *B* was also machined, so that the bushing would enter the work easily.

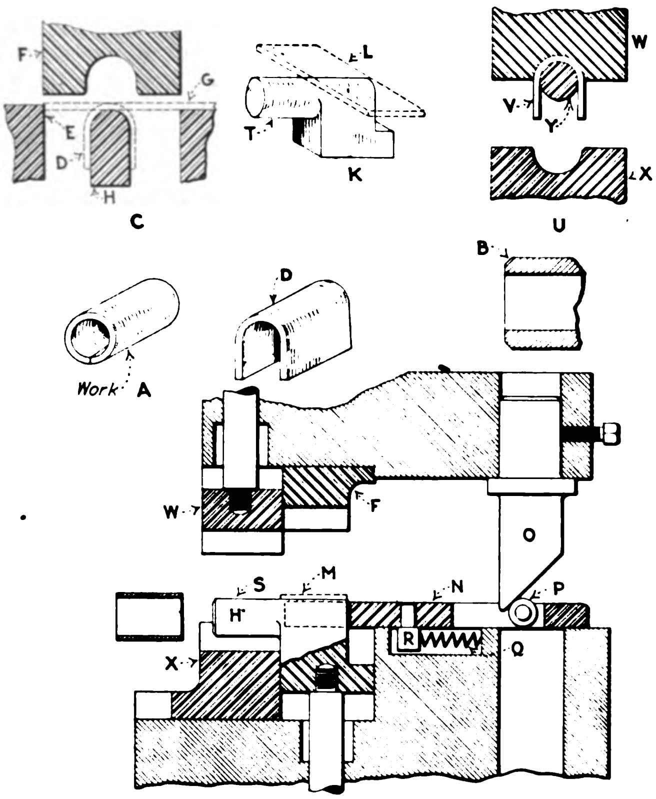


FIG. 478—DIE USED FOR FORMING BUSHING

As a large production of these bushings was required, the die shown was designed to meet the requirements, and it was found that the bushings obtained were within the required accuracy. The bushings were made from strip stock, and before running through the die they were put through a shearing operation which cuts the bevel or chamfer *B*. The die shown cuts the blank to suitable length and does two forming operations at the same time.

The first operation, shown at *C*, bends the work in the form *D*. The stock stops against the portion *E*, and as the punch *F* descends the material is cut off to length at *G*. As the punch continues its downward movement it forms the work over the support *H*. A detail view of this part is shown at *K*, and a piece of work is shown in dotted lines at *L* before it is bent into U-shape. In the sectional view of this die the work is shown at *M* by dotted lines.

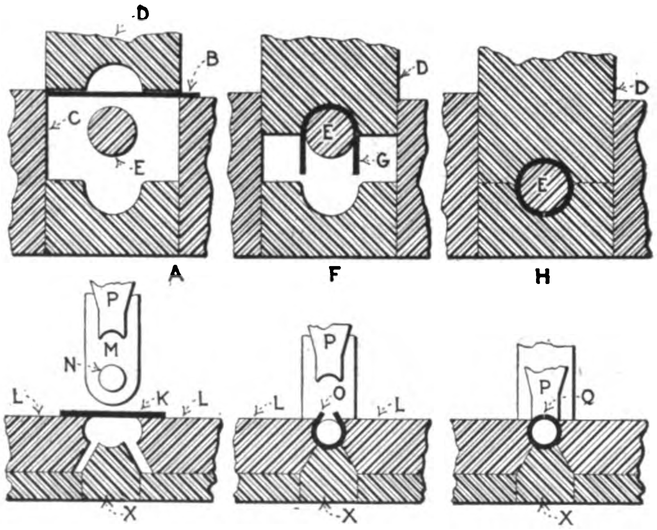


FIG. 479—DIES FOR FORMING BUSHINGS

After the work has been cut off and bent to its first shape, the punch descends and the work is pushed for-

ward by means of a fork-shaped sliding plate N operated by the tapered pin O, which strikes against the roller P set in the plate. A spring Q thrusts against the pin R on this plate and forces it forward when the punch is withdrawn. As this operation is completed, the fork moves the U-shaped piece of work forward until it lies over the plug end of the support H, as at S.

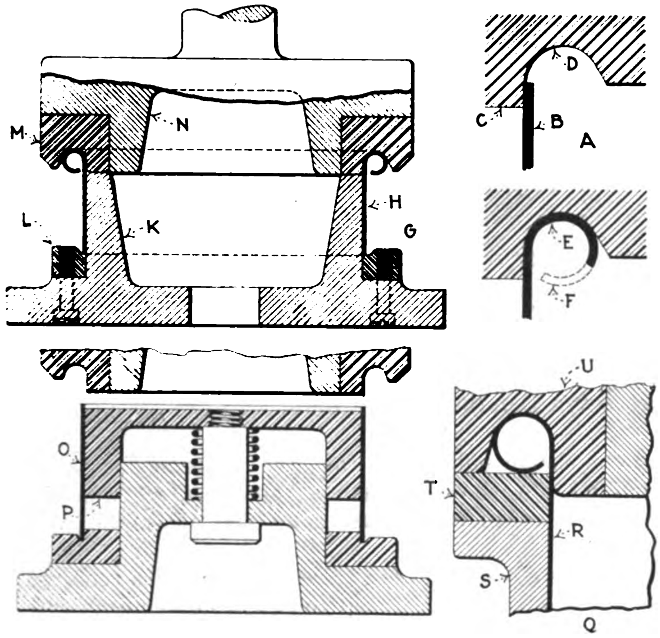


FIG. 480—TWO CURLING DIES

The view at K shows more clearly how this piece is moved forward over the plug section T.

The second forming operation is shown in the cross-sectional view at U. Here the work is indicated at V, and as the punch W is brought down it strikes the work and holds it on the arbor Y. As the action is carried further the work enters the die X, to which it is forced to conform, thus completing the circle. The punch ascends after this operation, and at this stage the plate N forces a previously semi-formed bushing forward, which pushes off the completed bushing. This operation is repeated so that at every stroke of the press a complete bushing is made.

By using this die with a friction feeding device, the trip of the press can be permanently set so that 90 to 100 bushings per minute can be produced. A bushing of this type is often made with a small oil hole in the center, and if this is desired it is possible to put a punch in the die F and a hole in the support H. The die is so designed that the parts are interchangeable and various sizes of bushings can be produced.

Other Methods of Producing Bushings

Two other methods of producing bushing forms are shown in Fig. 479. In the example A, which employs a curling die, the stock B is fed against the edge of the die at C to determine the length. The punch D is arranged so that it shears the blank and carries it down over the pin E, which is supported in a slide by means of heavy springs. The diagram at F illustrates the position taken by the blank G over the pin E. A continuation of the movement downward causes the edges of the blank to enter the lower die and follow it around, thus producing the completed bushing as shown in diagram at H. When the punch recedes, the pin follows it upward and leaves the bushing exposed so that it can be removed by sliding over the end of the pin.

Another method of producing the same bushing is shown in the lower part of the illustration. The blank K is located on the die L and the punch M carries a pin N, which comes down on the blank and forces it against the anvil X and between the movable members of the die. A continuation of the movement causes these two movable members to close in on the work until they have formed it to the shape shown at O. Immediately after this the punch P strikes and finishes the form as at Q, thus completing the operation. The punch M which carries the pin N is obviously mounted on springs of sufficient stiffness to develop the necessary pressure in forming. These two examples illustrate the application of closing-in attachments to forming operations.

Dies which form a circular bead around the edge of round work and which bend the end of work in a circular bead are also called curling dies. Examples which illustrate the use of curling dies are butt-hinges, water pails, funnels, automobile horns, cooking utensils, etc. All of these parts have a curled portion which is made by a curling die, and although they may be entirely different, the principle used is the same in each case. Fig. 480 shows two examples of curling dies and illustrates the principles employed in work of this kind. At A is shown the work B which is to be curled in the die C. This die supports the back of the work, and as it is brought down the work curls around the formed edge D and produces the shape shown at E. The amount of curl obtained is governed by the stroke of the press. In most cases the curl is made as shown by the dotted lines at F.

A die for curling a round tube of large diameter is shown at G. The work H is set over a ring K and locates on the plate L. The punch is provided with a curling die M which is located in a body N. The operation of this die consists of bringing the punch down on the work until sufficient curl has been produced. In this case the curling die M stops against the ring K.

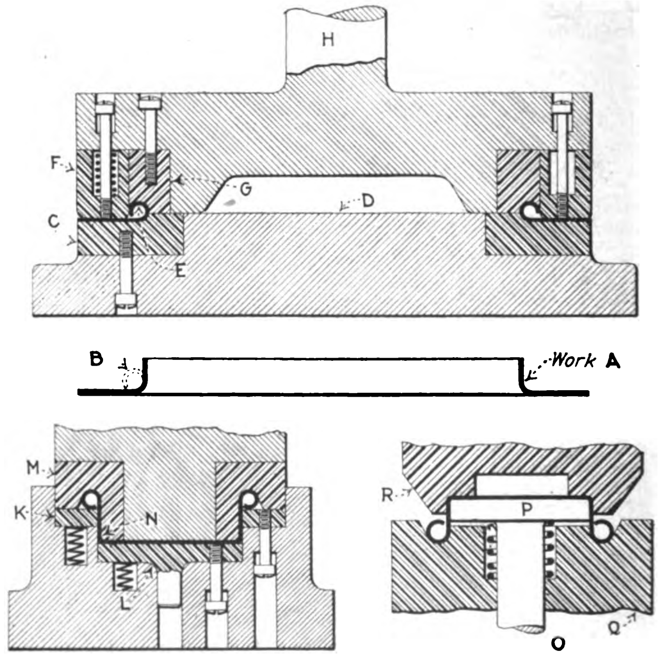


FIG. 481—TYPES OF CURLING DIES

The lower illustration is for a similar operation, although the die is of somewhat different construction. When the punch is in its upper position the work O is slipped over the ring P, which is mounted on a spring

slide and has an action similar to that of a stripper. The function of this ring is to prevent the stock from buckling when the die is brought down. The work is curled in the same manner as shown above and the construction of the die is somewhat similar.

It is sometimes found necessary to locate work in a bushing rather than on a plug, and at *Q* is shown a diagram to illustrate this method. The work *R* is located in the ring *S*, and the latter is provided with a hardened steel ring *T*. As the curling die *U* comes down on the blank, the work curls in the position shown and strikes against the ring *T* which determines the proper shape.

Examples of Curling Operations

Some other examples of curling operations are shown in Fig. 481. At *A* is shown a piece of work which is to be curled as indicated at *B*. The die used for this operation is shown directly above it. The locating ring *C* is fastened to a cast-iron shoe *D*, and the work locates on a previously formed radius *E* on this ring. The punch is provided with a pressure ring *F*, so that as it is brought down it pinches the work between it and the ring *C*. Then as the punch continues downward the curling die *G*, which is shaped to the required form, curls the work as shown. The pressure ring *F* assists in curling the work as the punch moves to its extreme downward position. The curling die *G* is fastened to the cast-iron punch by means of screws, and the punch is held in the press by means of the shank *H*, in the usual manner.

There are times when work of considerable height requires a curling operation, and in cases of this kind a special press having a long stroke is required. A press of this style is not always available, however, and the work can be located in a sliding die which can be drawn from under the punch for removal purposes. After another piece has been put in, the die is again slid back ready for the next operation.

There are cases where a tube requires curling at both ends, and the die for an operation of this kind is constructed along the same principles as those shown, with the exception that the locating ring at the bottom is made to the form of the curl required and the work is free to float while the curling dies are coming in contact with each other, thus curling both ends.

Sometimes it is necessary to curl a piece of work inside rather than out, as shown in these examples. An operation of this kind can be performed successfully in the same manner, although the stock being curled is forced into a smaller diameter and is therefore likely to wrinkle when it is compressed. If a curl of this nature is to be performed on heavy metal it is often necessary to heat is before the operation in order to insure an accurately formed job.

The lower part of the same illustration shows a cover which is to be curled. In this die the work locates in a pressure ring *K* and rests on a pressure pad *L*. The punch or curling die *M* is provided with a pilot *N*, which locates on the inside of the work and prevents it from buckling. As the curling die is forced down the work is curled, and at the end of the stroke the ring *K* and pad *L* strike bottom as shown in the illustration.

Curling Operation With Work Inverted

At *O* is shown a die for the same piece of work, although the construction is much more simple than the examples just shown. In this case the work is reversed and put in the die in the opposite direction. The work locates on a pressure pad *P* which is suspended above the curling die *Q* a suitable distance so that it will seat properly. The punch *R* on its downward stroke fits over the work, and as it continues downward the curling operation is completed.

In the construction of curling dies it should always be remembered that there is considerable wear on the dies where the metal slides around in curling, due to the friction of the stock around the form, and therefore dies of this kind should be made of tool steel and carefully hardened. The curling surface should be lapped to insure a smooth sliding movement of the stock passing over it during the operation of forming.

The Dealer's Problems

By J. Bainter

The same merchandising methods that were employed during the war for selling supplies to machine shops certainly have no place in the present order of things. Although everyone knows this and dealers have had to revise their methods in more than one particular since the war, some good might result from reviewing the dealer's problems. The fact that the dealers have already survived what is probably the hardest part of the trial is, of course, some encouragement for the future.

The trouble with the present market is that the margin left to the dealer is too small to enable him to continue his business as he formerly operated it. His salvation lies in reducing the overhead expense connected with selling. The outstanding features in such a program are the necessity for a higher turnover and a decrease in the inventory.

Standardization and simplification of lines are the biggest helps that can be given to the dealer. This work can be carried on, of course, by manufacturers within their own organizations so as to decrease the number of their products, although it is especially desirable that types and sizes of equipment be standardized throughout the whole branch of an industry by means of trade associations. Great cuts in inventory have been obtained by progressive dealers through standardization. By stocking only the popular lines and those that have a quick turnover, it is usually aimed to bring a turnover as high as four complete cycles per year. True, this goal is not frequently reached.

All the expenses connected with merchandising are very high, but the one that probably deserves the most attention is that of the salesman's wage. The method of compensating salesmen has been undergoing a slow change, and it is to be expected that the near future will bring out very many bonus and profit-sharing plans. Already such plans have shown their value.

If the European plan of charging the customer for services given him could be adopted, the dealer would be on a very much more secure basis. Although we are not advocating a departure from the American plan, there are many points which the customer should keep in mind when ordering from his dealer. If the buyer knows how to save the dealer from unnecessary expense, the saving that the dealer derives from such transactions will in the end reflect to the buyer himself.

Trade Apprenticeship Progress

This report is the result of the combined study and experience of a group of men experienced in training, familiar with the best method in current use, and also conversant with the literature, equipment, and methods of the best organized training departments in industry.

A long step has been taken in training young men for the Printing Trades. While only a beginning, it shows what can be done in any industry that will develop a well organized central educational department under a progressive committee on education and with competent supervision. The State of Wisconsin set a notable example by adopting trade apprentice laws that encourage both the employers and the apprentices to take advantage of a well-organized system under state supervision. So far as can be ascertained, this is the only state attempting to train skilled mechanics with the aid of an apprenticeship law.

Equal distribution of the burden of training can be accomplished only through frequent solicitation by some neutral body,—someone constantly prodding the less spirited into seeing the necessity for apprenticeship. Not only must other employers be sold to the idea, but also the co-operation of the journeymen must be secured, as well as that of prospective apprentices, their parents, and the schools. Standard training courses must be developed so that a graduate apprentice will be capable of holding a journeymen's job in shops other than his own.

Fulfillment of indentures requires outside supervision such as is possible under an apprenticeship law. The fact that the state becomes a party to the indenture impresses the apprentice with the assurance that he is going to receive some attention and that he is expected to live up to his agreement. After a three-month trial period, any contract of apprenticeship may be cancelled when good cause is shown. The actual ages when boys should serve apprenticeship are from 16 to 20 years, or 17 to 21 years, assuming a four year apprenticeship course.

Co-operation Between Industries and Schools

There are two direct methods of co-operation between schools and industry: Teaching in school subjects which will show the value of apprenticeship; and teaching those subjects in continuation schools which will supplement the practical apprentice courses conducted by the industries. School at the shop or place of business is to be preferred to instruction given in school buildings or away from the plant.

The characteristics of an industrial teacher are likely to be decidedly different from those of a teacher in the ordinary school. He, or she, must have the point of view of the industry which can be obtained only by experience in it. Industry can contribute not only material but also men qualified to teach.

If industry is to get the better class of boys, it must go after them. These boys will rarely go to the factory looking for jobs. Because of the age factor, we will expect to find our best material in either the junior or senior high schools, or possibly through some organization like the Y. M. C. A. or Boy Scouts where energetic boys may be found who have had to drop out of school for economic reasons but who have in them the making of good men. If the teacher will visit the shop often, and likewise, if those responsible for the boy in the shop, will visit the school often, they will find a common ground where suggestions looking to the correlation of school and shop work may be worked out to the decided advance of all concerned.

The length of an apprenticeship varies according to the trade, for the more skillful the work and the more branches, the longer the time required to master it. In the industrial and manufacturing fields, mechanical apprenticeship is more subdivided than with the railroads. They have a tool maker's apprenticeship varying in length from two to five years. Machine operators from two to four years, erecting or assembling two years, autogenous welding one to four years. The railroads combine all of these into one trade under the name of machinist apprentices, and the boy is taught each of them in four years.

Work Schedule for Machinist Apprentices

The school work for a machinist apprentice requires 200 drawings, 640 problems, 300 examination questions. The schedule of shop work covers: cold saw, 2 weeks; drill press, 1 month; shaper, 2 months; slotter, 1 month; lathe, 6 months; vertical boring mill, 1 month; horizontal boring mill, 1 month; milling machine, 1 month; planer, 1 month; brassroom machines, 3 months; toolroom machines, 2 months; air pumps, 1 month; cutout cocks, 2 weeks; triple valves, 2 weeks; brake valves and testing air, 2 weeks; firedoors, grate shaker and reverse gears, 2 weeks; boiler mountings, 1 month; cylinder and frames, 1 month; piston valves, 2 weeks; stokers, 2 weeks; cab work, 1 week; driving boxes, 1 week; spring brake and truck gang, 2 weeks; guide and pistons, 1 week; crosshead and piston bench, 1 week; piston valve bench, 1 week; rod bench, 1 week; link bench, 1 month; reverse lever and shaft bench, 1 month; valve gang, 1 month; welding, 2 months; roundhouse, 6 months; wheel gang, 1 month; layout bench, 2 weeks; miscellaneous, 2 months; giving a total of 48 months.

When a young man or woman just out of school fails to make good, in industry, or in business, the fault may frequently be found in industry itself rather than in the schools. The power to analyze should be a very prominent and conscious aim on the part of the schools, and of students as soon as they become mature enough to appreciate it. The complete solution of this problem so far as business and industry are concerned will be found in having some one in charge of new employees whose duty it should be to lead them through what may be called an adaptation period—the fundamental idea of the vestibule school—and to help them to become adjusted to their new work.

Abstract of a committee report presented at the first annual convention of the National Personnel Association, Pittsburgh, Pa., Nov. 8-10, 1922.

Attaching Gears to Pinion Shafts in Black & Decker Drills

In an article on the manufacture of Black & Decker drills in the October 12 issue of the *American Machinist*, the statement was made that "The gear seats on the pinion shafts are knurled to make the gears a tight fit when pressed on," giving the impression that this method was followed in all drills made by the Black & Decker Mfg. Co. This method which was formerly practiced only on the smallest drill—the quarter inch—has now been abandoned.

The gears in all other sizes have always been keyseated and pressed on the shafts over Woodruff keys, a practice now extended to the quarter inch size.

Industrial Cost Accounting for Executives

Fourth Article—A Summary of the Cost Accounts and Journals—Material, Wages and Burden Accounts—Controlling Accounts—Different Kinds of Journals

By PAUL M. ATKINS

IN THE previous article we considered briefly the elements which go to make up the cost of the finished product. Here we are to take a hasty glance at the various accounts and journals by means of which these elements are to be recorded. In later articles the details which are passed so hurriedly here or are not mentioned at all are explained at length. It is easier to understand how they all fit together to make a whole if we first look over the entire system even though the details themselves, at this time, are rather hazy and fail to be clear.

The first cost element which was discussed was material and so it may be appropriate to commence our study of the cost records with those needed for it. Before doing so, however, it will probably be well to give the definitions of two or three words which will be used with considerable frequency and about which all writers are not entirely agreed. Their exact definition is not a matter of any great importance just so long as everyone obtains the same idea from their use.

Three Different Kinds of Materials

From the point of view of cost-accounting there are three different kinds of material around factories: stores, worked material and merchandise. Stores includes all materials which are purchased from outside suppliers as long as they are not changed from the form or condition in which they are received at the plant. Such items as raw stock, rough castings, purchased parts and supplies, when they are bought, not made, all fall under this head.

Worked material is used to indicate all material which has been worked upon in the factory and then sent to the storeroom to be held till needed for other orders. Such things as parts and sub-assemblies, made in some department or departments of a factory to be used on various assembled products are examples. There are not a few parts which might be stores at one time and worked material at another, depending on whether they are bought outside or made inside the factory.

Merchandise is the finished product in saleable condition. It will sometimes occur that parts or sub-assemblies will be sold for repair parts but if they are primarily intended for use in the production of merchandise, they will be treated as worked material and not as merchandise. The reason for the differentiation is primarily a cost-accounting one and is necessitated by the nature of accounts required for recording the several kinds of material. The reason should be clearer after the following paragraphs are read.

Perhaps the most satisfactory way to approach the problem is to investigate first the accounts needed for recording the movement of materials and then to study the journals necessary for preparing the entries for these accounts. In the first place, there should be an account for stores, or more than one if it seems desirable. The stores account should be debited with the value of material purchased and received, and credited when material is withdrawn from the storeroom for use. The balance represents the value of the stores remaining in the storeroom.

There should also be a worked material account, subdivided if necessary, which should be debited with the value of the completed worked material and credited with the value of the worked material withdrawn. The balance gives the value of the worked material remaining in the storeroom.

In addition to this account, in which is recorded the value of the finished, completed worked material, there also will be a worked material in process account in which is entered the value of the worked material while it is in process of being made in the factory. It is one of the most important accounts in the cost system for it provides a figure for an inventory which is otherwise practically unobtainable. Of course, this account should be subdivided if the worked material account is divided, and in the same fashion. It is credited with the value of the completed worked material, the same figure which is debited to the worked material account. It is debited with the cost of the various elements which go to make up the worked material—labor, material, burden, and direct charges.

There should also be two sets of accounts for the merchandise—a merchandise account to be debited with the value of the completed merchandise and credited when the merchandise is sold, and a merchandise in process account which is quite similar in its make-up to the worked material in process account, forming a record of the value of the merchandise being worked on out in the shop. As before, the credit to the merchandise in process account is a debit to the merchandise account. In the same way, both accounts may be subdivided if the nature of the product seems to make it desirable.

Wages and Their Account

So much for the records of material in its various stages. A number of accounts are necessary to provide a record of the different kinds of material and to permit the ascertaining of their value at various stages in the course of their progress through the factory. The records of wages are much simpler and require only one kind of account, the payroll account, though it is not infrequently subdivided for convenience. It is credited with the value of the work done by the employees measured in terms of time or output and debited with the amount paid for labor when it is paid.

It might seem at first glance that since the two amounts are always the same there should never be any balance in the payroll account. If the workers are paid on a weekly basis and the accounting period is taken as a month, it is evident that only occasionally will the two coincide and even when they do, the entries are not made at the same time. Hence it will often happen that wages will have been earned but not yet paid for or payable and so there will be a credit balance called the "accrued payroll" which appears as a

For the author's forthcoming book.

liability on the balance sheet for it represents what is owed to the workers by the company. All the balances of the material accounts, on the other hand, are debit balances and are entered as assets on the balance sheet.

It is now time to turn our attention to the matter of burden and the records needful for that element. In the first place, it is necessary to provide expense accounts in which may be accumulated the expenses as they occur. Only the principal expense accounts, those for the major subdivisions of the business, will be kept in the general ledger. Administration, selling and manufacturing expense accounts are the only ones which need be mentioned here. In later articles it will be pointed out that it is often convenient to divide the manufacturing expense account in two. The debits to these three expense accounts are the charges for indirect labor, indirect materials, repairs and maintenance, depreciation, insurance, outside charges of various kinds and all other items which are a part of the cost of running the business during the period in question.

Since they are expense accounts, they must be closed at the end of the period. The manufacturing expense account is closed into the manufacturing burden account. The selling expense account is closed into a selling burden account, if the company has planned to ascertain the cost of selling the various units of its product. If there is to be no selling burden account, the balance should be charged directly to the profit and loss account.

If there are two burden accounts, the administration expense account should be debited part to one, part to the other. If there is no selling burden account, it may either be debited wholly to profit and loss or part of it to that account and the rest to the manufacturing burden account. There is not space here to explain how the division is made, but it will be discussed in full in a later article on the "Distribution of Expenses."

The handling of the selling expenses is rather outside the scope of the present series of articles. In general, it is somewhat similar to the treatment of the manufacturing expenses, but, to clear the matter up, let us assume that the easy, though not very satisfactory method of charging them all to the profit and loss account is followed, and turn our attention now to the matter of the manufacturing burden account.

The manufacturing burden account is debited with the expenses which are incurred by the various departments which are engaged directly or indirectly in carrying on production and also the proper share of the expenses of those departments which aid production, in other words, the administration departments. The debits, as have been noted, come from the manufacturing and administration expense accounts. The credits are two, one for the earned burden which has been allocated to the product—worked material and merchandise—and the unearned burden which is the balance which should then normally be charged to the profit and loss account.

There are a few other accounts which should be mentioned at this point in connection with the expense accounts. Certain expenses are paid in advance of the time when the benefit from them is received as in the case of insurance premiums. Hence it is necessary to set up a prepaid insurance, for example, to which the insurance premiums can be charged as they are paid, and which should be credited each month when the charge for the insurance for the month is made, to the appropriate expense account.

In some cases, on the other hand, a benefit is received but is not paid for till after the close of the period involved. Real property taxes are an illustration, for

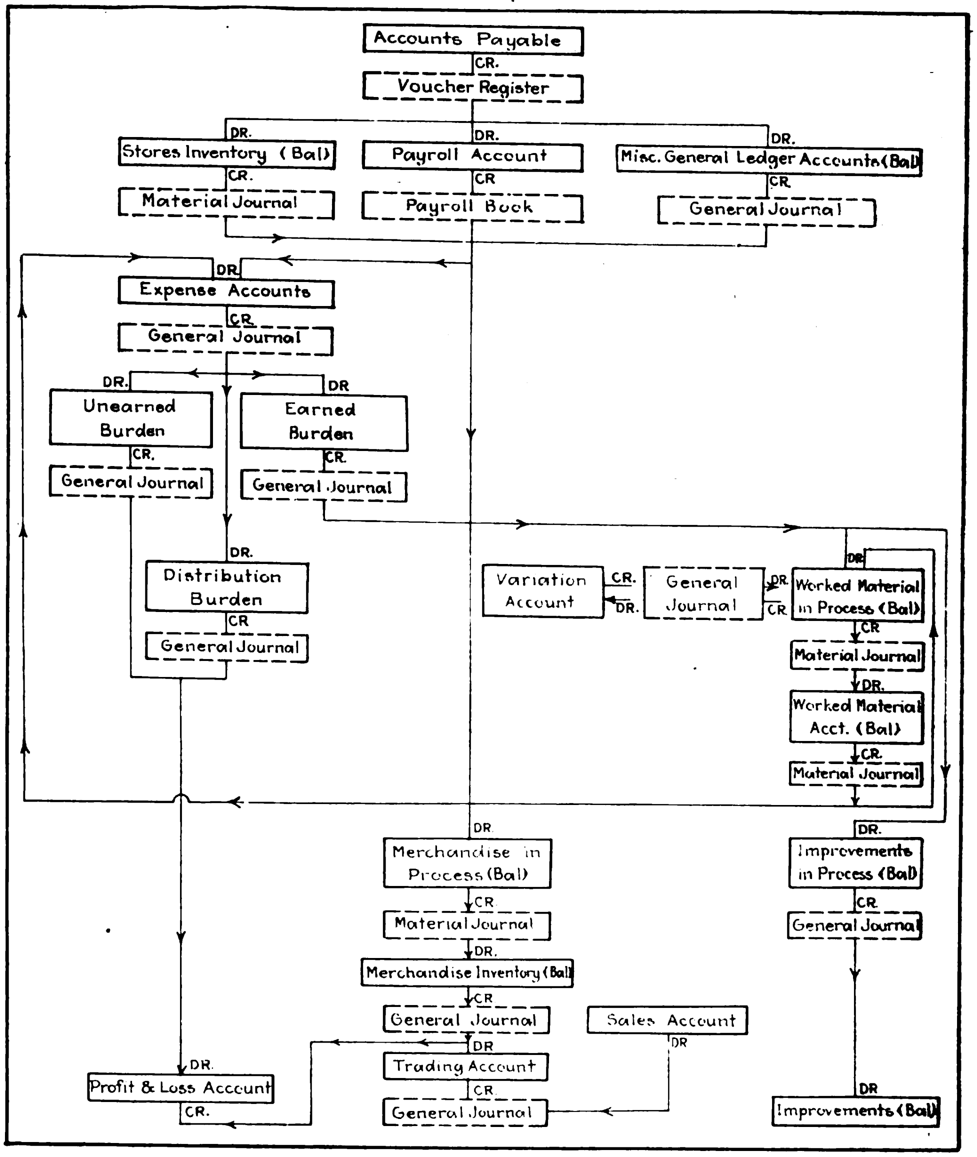


FIG. 2—A CHART SHOWING THE PRINCIPAL COST ACCOUNTS AND JOURNALS

in many instances they are payable and even are not known till the end of the year. It is proper, therefore, to set up a reserve account for taxes in which may be accumulated a reserve to cover the payments when they come due, the corresponding debits having been made to the monthly expense accounts during the year.

Before passing on to a very brief survey of the journals, one other set of ledger accounts deserves a passing mention. These are the various fixed asset accounts like those for machinery, buildings, tools, furniture and fixtures. There should be one of them for each of the principal groups of fixed assets and they should vary according to the classification made of these items. There will sometimes be an "in process" account for each group, but more frequently, except for very large concerns, there will be only one improvements in process account in which will be recorded the value of the various assets while they are in course of construction.

The operation of fixed asset accounts follows, in general, the methods employed for the worked material and merchandise accounts. There is one important distinguishing element, however, that must be mentioned here. All the fixed asset accounts, with the possible exception of tools, should have a corresponding reserve for depreciation account which should be credited monthly with the amount of the depreciation charged as an expense. They show at all times the amount of the depreciation on that class of assets.

It should be noted that many of the accounts mentioned are controlling accounts supported by subsidiary accounts, often not in account form, which exist elsewhere. The stores and worked material accounts are detailed on the balance of stores and worked material cards. The same is true for the merchandise account, if merchandise is made for stock and not shipped as soon as made. The "in process" accounts for worked material, merchandise and improvements are supported by the record of the order costs in the cost department.

The controlling expense accounts are given in detail in the form of individual expense accounts for each subdivision of the expense classification. The fixed asset accounts and the corresponding depreciation reserve accounts are represented in the form of a plant ledger. All of these details and their relationship to the controlling accounts in the general ledger are discussed in subsequent articles.

It is, of course, necessary to prepare the entries for these accounts in some kind of a journal. For some of the entries a regular general journal is most adaptable, and that is a book which should need no explanation. The voucher register is another form of journal which is very useful and which is frequently used, so it needs no description at this place. Certain rulings for the the voucher register are discussed in a later article. The payroll book is also a well known journal.

There are, however, two other journals, and sometimes a third, which are needed and which are not commonly found. One is the material journal which is ordinarily divided into several parts. One part is for the purpose of recording the withdrawal of stores and serves to control their distribution. Another does the same thing for worked material and under some conditions there is a third for merchandise.

There is also a section for handling the value of the worked material completed and turned into the storeroom, and often one also for merchandise. The material journal provides a simple means of handling what is often one of the most difficult practical problems in cost-accounting and is explained in detail in a subsequent article. Similar in purpose and ruling to the material journal is one for burden, to be used when the machine rate or process method of burden application is employed.

This has been a long article and in the effort to compress a great deal into a small space it reads almost like a catalog. There is in it, however, the skeleton of a whole system of cost-accounting and it will repay careful study. Many of the details, as has been pointed out in places, are developed in later articles, for the intention is to make clear all of the points given to the reader before the series is completed.

To aid in grasping the interrelationships of accounts and journals described in this article, the accompanying chart (Fig. 2) has been prepared. The accounts are shown bounded with solid lines and the journals with dotted lines. Too much must not be expected of a chart which tries to show so much so briefly. It will not bear a minute analysis, but it should be used rather to gain a general idea of the whole subject.

Winning the Coal Saving Game

By Charles W. Lee

The game of saving coal is very popular just now, for obvious reasons. There are good ways of playing it and there are some no good at all. Let me illustrate:

Along comes my doctor with a circular intended to promote something out of a bottle or a keg, which it is claimed will achieve the winning of the coal-saving game, and wants to know what I think of it. (Incidentally, I often wonder why my doctor or lawyer, expects, and very properly so, to send me a bill for any advice asked for by me; whereas he would be much surprised if I were to send him a bill for advice asked for by him.)

After carefully reading the circular, I spoke a sort of parable something like this: A "patient"—which is a very good name for him—comes into the doctor's office complaining of not feeling well. The doctor examines him, finds that he has a mild case of something or other, hands him a filled bottle, and says: "Take a spoonful of this every two hours, eat sparingly, particularly of red meats, take plenty of exercise and get plenty of fresh air. Soon you will be O.K." The patient follows instructions and quickly recovers.

There arrives another patient with something the matter, something entirely different from that which ailed the first one. The doctor gives him a bottle of the very same stuff that he gave the first patient, and the same advice about diet and exercise. Patient No. 2 uses the "medicine," follows instructions and speedily recovers.

Now, doc, (I continued) the stuff mentioned in the circular, it seems to me, is comparable with the stuff in the doctor's bottle. The directions in the circular for running the furnace when using the stuff show a mighty good way to run a furnace anyhow and I think if you will carefully follow these directions you will save coal. Moreover, you will save just as much coal, whether you mix the stuff with the coal or don't. Do you see the point? He said he did.

I am not a chemist or a coal expert, but I am a competent operator of a domestic furnace. If there is any truth in what I told the doctor, it goes just the same for the furnace under the boiler as the furnace in the cellar.

Denmark—Exports of Machines for Metal Working or Wood Working with Drilling (Bore) Machines

"Masckiner til Metalforarbejdning Traeforarbejdning samt Boremaskiner"

TABLE IX

Country	1910 Quantity 100 kg	1911 Quantity 100 kg.	1912 Quantity 100 kg	1913 Quantity 100 kg.	1914 Quantity 100 kg.	1915 Quantity 100 kg.	1916 Quantity 100 kg.	1917 Quantity 100 kg	1918 Quantity 100 kg.	1919 Quantity 100 kg.	1920 Quantity 100 kg.
Germany	400	60	527	322	75	4,338	2,395	3,387	1,005		615
Great Britain	37	36	66	178	18	129			675	735	3,281
Norway	51	44	129	64	73	1,002	4,618	4,739	7,157	6,838	2,532
Sweden	513		60	166	3,449	5,553	11,654	8,380	4,326	3,744	2,138
Finland	25		7	1	8	1,816	456	407		683	387
Russia	525	1,800	673	1,064	1,709	6,387	32,784	12,830			
Netherlands	38	217	88	1	3	150	380	1,495	3,088	868	702
Belgium	120	77		44	1					350	3,118
France	159	402	123	68	35		561			1,208	2,785
Italy	83		34	2						115	213
Austria-Hungary	29	26	37	60	166	1,790			128		
Switzerland		52	5		68						
Bulgaria			42								
Portugal										35	310
Spain											1,297
Hamburg				54	35	352					
Iceland and Faroe Islands			63	31	2	23				124	137
Morocco											46
Algiers and Tunis											137
British South Africa										61	237
China				3,387	1,636	174			1,361	360	363
Siam									114		131
Dutch East Indies										48	805
British India											439
Straits Settlements											46
Australia		12	97	15	47						289
New Zealand											49
United States									1,152		
British North America				40							
Argentina									127	855	2,633
Brasil											846
Other South American										246	795
Other or Unknown Countries	16	17	15	44	17	90	431	5,746	5,335	126	207
Total (Quantity in 100 kg.)	1,996	2,743	1,966	5,541	7,342	21,804	53,279	36,984	22,721	16,396	24,538
Total Value (Kronen)	400,000	493,000	489,000	951,000	1,255,000	5,127,000	16,401,000	9,831,000	6,566,000	4,687,000	8,547,000

Denmark—Imports of Metal Working Machinery and Drilling Machinery

"Maskiner til Metalforarbejdning and Boremaskiner"

TABLE X

Country or Region	1910 100 kilograms	1911 100 kilograms	1912 100 kilograms	1913 100 kilograms	1914 100 kilograms	1915 100 kilograms	1916 100 kilograms	1917 100 kilograms	1918 100 kilograms	1919 100 kilograms	1920 100 kilograms
Hamburg	137	109	30	79	203	5					
Germany	3,798	4,121	5,081	7,461	7,665	2,209	4,223	1,886	2,637	22,295	25,810
Great Britain	236	504	1,244	1,462	847	780	834			206	1,011
Norway	9	184				172	170	606	247	391	124
Sweden	268	470	520	541	1,038	2,711	4,750	2,235	5,362	4,461	1,703
Holland	45	129	57	8	19	122					
Switzerland		90	4	9	17					19	14
France	11									46	1
Austria-Hungary							82				
United States	217	361	487	550	534	673	1,458	2,509		3,537	2,142
Other or unknown countries	22	11	55	53	37	18	68	34	29		
Total Quantity (100 kgs.)	4,743	5,979	7,478	10,163	10,360	6,690	11,585	7,270	8,275	30,955	30,805
Total Value (Kronen)	441,000	467,000	586,000	848,000	868,000	636,000	1,338,000	1,23,8000	1,880,000	4,701,000	5,275,000

Par value of Krone is 26.80c.

Formulas for Cutting and Measuring Threads

Information a Customer Needs for Checking—Practical and Theoretical V-Thread Flats—Distinction Between Helix and Lead Angles—Acme Thread Data

By JACK WILLIAMS

AN ARTICLE entitled "Gaging Acme Threads Without Special Wires" written by H. A. Pearson, appeared on page 830, Vol. 51 of *American Machinist*. I made a rectigraph copy of this article, which has proved to be of valuable assistance to me in my work. I found, however, upon careful study that only the formulas could be depended on, as there were slight errors which it was necessary to correct in both the text and the constants.

The formula for screws produced the same result as that given for taps. The former read as follows: $4.9937D - 3.8667W +$ outside diameter of screw equals the micrometer reading. The letter D represents the diameter of the wires and the letter W the width of the opening at top of the thread. This formula is open to two serious objections. It is stated in terms of width of opening at the top of the thread when it should have been given in number of threads per inch; its use is limited commercially to threads having a lead angle of six degrees or less.

I have worked out and compiled a set of formulas that should relieve foremen, toolmakers and draftsmen of a great deal of figuring, besides putting an end to a vast amount of correspondence previously required between firms to clear up misunderstandings. The formulas were intended to cover Acme threads, as these threads seemed to be an endless source of trouble, but additional general formulas have also been derived. They are written in a manner easily grasped by the average layman and most of them are in terms of threads per inch, although some of them are also given in terms of pitch to allow the user a choice of mathematical procedure.

My reason for sending in the chart of Acme thread formulas is that I feel that publicity will invite constructive criticism. Possibly someone will either carry the work along and contribute additional data, or compute the maximum error as compared with their own commercial method or with theoretically correct formulas.

The five additional formulas, grouped under IV, which I will explain in detail, are particularly valuable. They may be applied to any symmetrical form of thread, except the square thread, and include the V, U.S.F., Whitworth, Standard International and Acme threads. The formulas for width of flat, however, cannot be applied to rounded or to sharp V threads.

The questions that are asked by shopmen when preparing to make special taps, screws, or gages, are these:

(1) What is the width required at the point of the threading tool?
(2) What is the correct angle of the threading tool?
(3) What is the lead angle to which the tool must be set?
(4) What diameter of wire is to be used in measuring the threads?
(5) What is the micrometer reading over the wires?

The answers to these questions should be enclosed with every shipment of goods so that customers can do their own checking and save the time now wasted in asking for this information, shipping goods back and forth, and arranging credits. If customers would demand it, the manufacturers would be glad to render this service.

At what particular lead angle it is necessary to begin making compensation in the shape of the threading tool is a commercial factor subject to change in accordance with the class of work required. If the lead angle is set at six degrees, and so advertised by the manufacturers, it will soon be grasped by the trade and when customers require especially accurate work they will specify it on their orders. The error in tool angle and consequently in thread angle for a 60-deg. thread of 6 deg. lead angle is 0 deg. 16 min., and for a 29-deg. thread is 0 deg. 10 minutes. A good commercial limit on thread angles is 0 deg. 20 min., so that a 6-deg. lead angle is well chosen and will apply to thread angles of even greater than 60 degrees.

Two main points which strongly emphasize the commercial side of thread measurements are featured in the chart shown in the accompanying illustration. One point, brought out in an exaggerated way, shows the change in angle and the corrected width of the tool point. The other point is the division of the formulas into three groups, one of which applies to all lead angles. The other two apply to lead angles above and below 6 deg. respectively.

Let us use the following symbols to express the answers to the five questions previously mentioned:

(1) $f =$ width at point of the threading tool.
(2) $\phi =$ one-half the corrected angle of the threading tool.
(3) $\alpha =$ lead angle for setting the threading tool.
(4) $D' =$ diameter of the measuring wires.
(5) $R'' =$ micrometer reading over the wires.

In the process of manufacturing, as soon as the answers to (1), (2) and (4) are known, they should be given to the person who is responsible for the tools. In this way, the tools and the proper size of the wire will be on hand for measuring when the work is ready for threading.

Some firms have found out, after delays and an undersized product have resulted, that it is impossible to manufacture a theoretically sharp V-thread for a given pitch diameter. In other words, the formula: Single depth of V thread $=$ pitch $\times \cos 30° =$ pitch $\times$ 0.86603, which was extensively advertised until recently, was not at all practical. For that reason, the formula does not appear in the catalogs of some tool manufacturers. Most of these manufacturers advocate the universal adoption of the U.S.F. thread while others are striving to bring about commercial harmony by persuading their customers to accept the U.S.F. thread on all pitches finer than 30 threads per inch.

Many manufacturers of V-thread tools, such as the

gage makers and those who use pipe threads, are familiar with the following formulas:

N = number of threads per inch P = pitch
Single depth of thread $= 0.8 \div N = 0.8P$
Width of flat at top or bottom of thread $= 0.03812 \div N = 0.03812P$
Height from flat to theoretical $V = 0.03301 \div N = 0.03301P$.

My reason for explaining the V-thread and its flat is that the same flat should be applied to V-threads of any angle, whether the angle is more or less than 60 deg., and it is not practical to decrease this flat for it is already the smallest flat that can be commercially maintained on a threading tool. Therefore, question (1) does not apply to this form of thread.

The terms "lead," "pitch," "lead angle," and "helix angle" must also be explained. Many engineers and draftsmen are primarily at fault for orders that read: "6 pi. double," "6 P.I. 29 deg. double lead," or "6 P.I. double $\frac{1}{12}$ lead." Such orders merely confuse the purchasing agents and clerks, when they hear the terms "pitch" and P.I. (per inch) interchanged. The pitch is the distance from the center of one thread to the center of the adjacent thread. The lead is the distance from the center of one thread to the center of the *same* thread, after it has made one revolution, measured parallel to the axis of the screw.

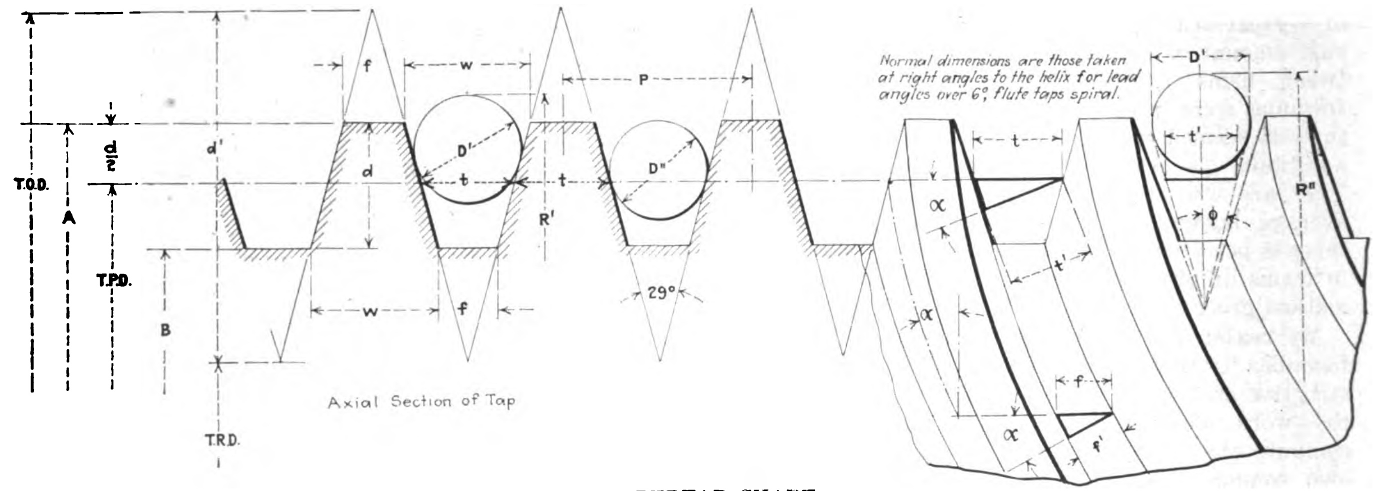
The National Screw Thread Commission does not differentiate between helix and lead angle but gives a formula for finding the helix angle. In my experience, however, the angle to which the workman sets his tool or work, is commonly known as the lead angle. In the Brown & Sharpe Gear Book, the formula is given:

$$\tan \alpha = \frac{\text{circumference}}{\text{Number of inches of spiral to one turn}}$$

But the author carefully avoids calling α the lead angle. Why should this uncertainty be allowed to continue? Is there no one progressive enough to say what is what?

To distinguish between the terms lead angle and helix angle, let us assume a universal milling machine set up to cut a helical flute in a tap, reamer, or similar tool. The table is swung from its zero position to the angle required by the helix and this reading represents the helix angle. The tangent of the helix angle is equal to: $\frac{\pi \times P.D.}{\text{Lead}}$

The lead angle is the angle between the helix itself and the plane normal to the axis of the work at the pitch diameter. It is the complement of the helix angle and its tangent is equal to: $\frac{\text{Lead}}{\pi \times P.D.}$ The *P.D.* in each formula represents the pitch diameter. This distinction is purely arbitrary and is set up solely for the purpose of making the formula clear. In my work, it is well understood but I do not know that the distinction is generally accepted. The following are examples of orders and inquiries that are made out correctly:



ACME THREAD CHART

T.O.D., *T.P.D.*, and *T.R.D.* indicate respectively the theoretical outside diameter, theoretical pitch diameter, and theoretical root diameter.

A = actual outside diameter of tap. The nominal outside diameter of the tap is the actual outside diameter of the screw.
B = root diameter of tap, and also of screw.
L = lead or advance in one revolution.
P = pitch or distance from center to center of adjacent threads.
N = number of threads per inch.
α = lead angle.
d = depth of thread.
d' = theoretical depth of 29-deg. V-thread.
f = standard width of tooth at top and standard width of space at bottom of thread. This is the commercially correct width of thread tool to use for lead angles up to six degrees inclusive.
f' = commercially correct width of thread tool to use for lead angles of over 6 degrees.
θ = ½ nominal thread angle.
t = standard thickness of tooth or space at *T.P.D.*
t' = normal width of space at *T.P.D.*
w = standard width at top of tooth and standard width at bottom of tooth.
D' = diameter of any measuring wire, but must be same or greater than D''.
D'' = commercially correct diameter of wire having contact at *T.P.D.* when α is equal to or less than 6 degrees.
R' = commercially correct micrometer reading over three wires when α is equal to or less than 6 degrees.
R'' = commercially correct micrometer reading over three wires for lead angles over 6 degrees.
ϕ = ½ the normal thread angle.

6 P.I. Acme Screw Thread, Double
6 P.I. 29-deg. Worm Thread, Double
6 P.I., ⅓-in. Lead, 29-deg. Screw Thread, Double

Give either the pitch diameter, the outside diameter, or both. The correct thread section will then be furnished. Other data, such as the number of pieces and the limits should not be forgotten. If 29-deg. threads are cut with thread milling cutters of the proper angle and width of flat, calculated from the formulas in IV, they will measure up to the correct sizes.

Everyone ought to know that 29-deg. threads when used on the lead screws of lathes, or on lifting jacks or valve stems, require a cutter with a flat wider than that of the cutter used to cut a worm thread, because of the difference in the root diameters. Manufacturers consider the word Acme as meaning screw, and, unless some reference is made to worm threads, will furnish Acme screw cut cutters.

If the foregoing paragraph is observed, there should be enough information sent out with each order to answer the five questions by means of the five formulas under IV. This information should prove to be of incalculable value to manufacturers and customers.

I. FORMULAS COMMERCIALLY CORRECT FOR ALL LEAD ANGLES
ACME THREAD ONLY

$$P = \frac{1}{N}; \quad N = \frac{1}{P}$$

$$L = \frac{1}{N \times 2 \text{ for double thread, 3 for triple thread}}$$

$$d = \frac{0.5}{N} + 0.020; \quad d = 0.5P + 0.020$$

$$\frac{d}{2} = \frac{0.25}{N} + 0.010; \quad \frac{d}{2} = \frac{P}{4} + 0.010$$

$$d' = \frac{1.9334}{N}; \quad d' = 1.9334P$$

$$A = \text{nominal outside diameter} + 0.020$$

$$B = \text{nominal outside diameter} - 0.020 - \frac{1}{N}$$

$$T.P.D = \text{nominal outside diameter} - \frac{0.5}{N} = \text{nominal outside diameter} - 0.5P$$

$$T.O.D = \text{nominal outside diameter} + \frac{1.43335}{N}$$

$$T.R.D = \text{nominal outside diameter} - \frac{2.43335}{N}$$

$$\cot \alpha = \pi \times N \times T.P.D. \text{ for single-thread taps}$$

$$\cot \alpha = \frac{\pi \times T.P.D.}{L} \text{ for multiple-thread taps.}$$

II. FORMULAS COMMERCIALLY CORRECT FOR LEAD ANGLES UP TO SIX DEGREES
ACME THREAD ONLY

$$t = \frac{1}{2N} \qquad t = \frac{P}{2}$$

$$f = \frac{0.3707}{N} - 0.0052 \quad f = 0.3707P - 0.0052$$

$$w = \frac{0.6293}{N} + 0.0052 \quad w = 0.6293P + 0.0052$$

$$D' = \text{any wire with same diameter as } D'' \text{ or larger}$$

$$D'' = \frac{0.51645}{N} \qquad D'' = 0.51645P$$

$$R' = 4.9937D' - \frac{2.43335}{N} + \text{nominal outside diameter}$$

III. FORMULAS COMMERCIALLY CORRECT FOR LEAD ANGLES OF OVER SIX DEGREES
ACME THREAD ONLY

$$f' = \cos \alpha \left(\frac{0.37069}{N} - 0.00517\right)$$

$$t' = \frac{\cos \alpha}{2N} \quad t' = \frac{P \cos \alpha}{2}$$

$$\tan \phi = \frac{\cos \alpha}{3.86670}$$

$$R'' = \text{nominal outside diameter} - \frac{2.43335}{N} + \frac{D'}{\sin \phi} + D'$$

$$\text{Minimum } D' = \frac{\cos \alpha}{2N \cos \phi}$$

IV. FORMULAS COMMERCIALLY CORRECT FOR ANY LEAD ANGLE
ANY FORM OF THREAD

$$f' = \frac{\cos \alpha}{2N} - \tan \phi \; (T.P.D. - B)$$

$$\tan \phi = \frac{\cos \alpha}{\cot \theta}$$

$$\cot \alpha = \frac{\pi \times T.P.D.}{L}$$

$$\text{Minimum } D' = \frac{0.5}{N \cos \theta}$$

$$R'' = T.P.D. - \frac{\cot \theta}{2N} + D' \; (1 + \csc \phi)$$

Automatic Control of Fire in Car Shops

A recent instance of fire control by the use of automatic sprinklers is of special interest to engineers and managers of shops of various kinds. The case in mind was the freight car erecting shop of the Turcot Works of the Canadian Car & Foundry Co., located near Montreal, Can.

The erecting shop is a large one-story building, 80 x 800 ft., all one area. The walls are of brick and glass in metal sash; the roof, light planks supported by unprotected steel beams and trusses. The distance from floor to roof is 39 ft. Five tracks run the length of the building. At the time of the fire they were filled with box cars, 75 in all. The shop is equipped throughout with a dry-pipe automatic sprinkler system controlled by six automatic air valves. Five metal fire curtains under the roof divide the system into six sections.

The fire broke out early in the morning of Oct. 17, 1922, in a box car in the center of the building. It was discovered by the watchman, who gave the alarm. A line of hose was stretched by the night shift at the plant but before this was brought into play the sprinklers overhead began to open. The fire burst through one end and the doors of the car and ignited the corners of nearby cars. The water from the sprinklers blanketed the blazing car and extinguished the fire in the nearby cars, thus confining the fire to the locality of origin.

The performance of the sprinklers was remarkable considering that the roof was 39 ft. high, and the nature of the obstructions to water distribution offered by the box cars. As the fire was directly beneath one of the divisional fire curtains the sprinklers in two sections opened, 10 in one and 11 in the other, 21 in all. The principal fire damage was to the burned box car, but no practical loss resulted, as the car was to be rebuilt. The damage to the building amounted to $50.00.

Federal Specifications for Leather Belting

The following is an extract from the specifications under which all purchases of leather belting will be made by the U. S. Government:

All belting leather shall be made from green salted hides and be free from brands, soft or spongy spots and open grub holes, excepting that when made into belting 30 per cent of the strips in any belt or roll of belting may contain a maximum of 3 open grub holes in each of such strips. The hides shall be tanned with oak bark or a combination of vegetable tanning materials. Animal oils and greases shall be used for stuffing the leather, or a mixture of these and mineral oils in such proportion as will provide maximum strength and pliability.

The use of epsom salts, glucose, barium chloride or other material for weighting the leather is prohibited. All leather after stuffing shall be thoroughly stretched while still damp and shall be left under tension until dry. The grain or hair side shall be finished smooth and the leather shall be thoroughly fleshed.

All strips shall be cut from the center portion of the hide at such distance from the backbone as to include only firm stock, and exclude second quality leather and at such distance from the root of the tail as will exclude all shoulder stock. No sectional strip shall be more than 54 in. in length, including the lap. The minimum length of any strip shall be 36 in. including the lap, excepting that in double belts $\frac{1}{8}$ of the total number of pieces may be between 20 in. and 36 in. provided that these short pieces do not occur consecutively. The minimum length shall not apply to the end pieces of rolls or cut lengths. In single belting the strips shall be joined shoulder end to shoulder end and butt end to butt end. In double belting the strips shall be joined shoulder end to butt end.

In all single belts 8 in. and over in width, backbone center strips shall be used. The backbone mark must appear running lengthwise approximately in the center of each strip. In all double belts from 8 in. up to 10 in. width, backbone center strips shall be used in one ply and the backbone mark shall appear running lengthwise approximately in the center of each strip. The other ply shall be cut from the location prescribed for first quality stock. In all double belts 10 in. and over in width, both plies shall be made from backbone center strips and the backbone mark shall appear running lengthwise approximately in the center of each strip. The same quality of leather shall be used in both plies of all double belting. The length of laps shall be within the limits given in Table I.

TABLE I—LENGTH OF LAPS IN INCHES

Ply	Thickness	Length of Laps: Belts under 6 in. in width	Length of Laps: Belts 6 in. and over in width
Single	Under 10/64	2½ to 6	3 to 8
	10/64 and over	3 to 8	3½ to 10
Double	Up to 17/64	2½ to 3½	3 to 4
	19/64 and over	3 to 4	3 to 5

The minimum distance between any two laps in the separate plies of double belting shall be 8 in. The points of all laps shall be at right angles to the edge of the belt. All laps shall run in the same direction The laps of both single and double belts and the plies of double belts shall be thoroughly cemented together. When pulled apart the cemented surface shall not appear glazed or shiny. The maximum variation from the nominal width shall be in accordance with Table II.

Copies may be had from the U. S. Bureau of Standards, Washington, D. C.

TABLE II—TOLERANCE FROM NOMINAL WIDTH

Width of Belting In Inches	Tolerance
Under 2	Not less than nominal
2 to 24 inclusive	1 per cent
Above 24	½ of 1 per cent

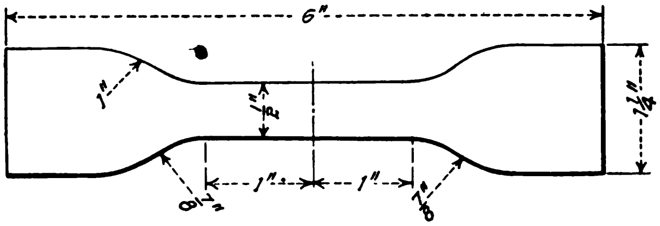
The thicknesses for the different grades of belting shall be in accordance with Table III.

TABLE III—AVERAGE THICKNESSES IN INCHES

Grade	Single Ply	Double Ply
Light	8/64 up to 10/64	15/64 to 17/64
Medium	10/64 up to 12/64	19/64 to 21/64
Heavy	12/64 up to 14/64	23/64 to 25/64

The average thickness shall be determined by measuring the thickness of 20 plies of the belt when rolled and dividing this value by the number of plies measured. No point in either single or double belting shall be more than $\frac{2}{64}$ in. thicker nor more than $\frac{2}{64}$ in. thinner than the average thickness. The excessive use of shims and filler strips and excessive splitting or leveling is prohibited. All belting shall be stamped on grain side with the maker's name and brand, and a stamp indicating the direction in which the belting is to run. Each stamp shall be repeated every 10 ft. throughout the entire length of the belting.

Waterproof dressed belting shall conform to all the requirements of this specification. In addition it shall be treated with a waterproof dressing. Waterproof belting shall conform to all the requirements of this specification. In addition it shall be treated with a waterproof dressing. The laps and plies shall be cemented with a waterproof cement. All leather shall have a minimum tensile strength of 3,000 lb. per square inch of cross-section and an average tensile strength for single belts of 3,750 lb. per square inch and for double belts of 3,500 lb. per square inch. The average shall be determined with five test specimens cut continuously lengthwise of the sample, omitting the lap. Test specimens of the shape and size as shown in the illustration shall be cut with a metal die.



THE TEST SPECIMEN

The laps of both single and double belting shall not open when subjected to a tensile stress of 2,500 lb. per square inch. The opening of the laps shall be determined by testing two specimens cut across the point of the lap lengthwise of the sample. For double belting the test shall be made on the single ply. The average elongation at a tensile stress of 2,500 lb. per square inch shall not exceed 15 per cent. The average shall be determined with the same five test specimens used for determining the tensile strength.

The following stretch test shall be made on the finished belting up to and including six inches in width.

Any section of a roll or belt shall be selected (which shall not be cut) on which gage marks shall be placed 10 ft. apart. Suitable clamps shall be attached on the marks so that the distance between the clamps shall be 10 ft. The section shall then be suspended in a vertical position from one of the clamps. Sufficient weight, including the weight of the clamp, shall be attached to the lower clamp to produce a tensile stress of 750 lb. per square inch of the average cross-section of the section being tested. The section after being subjected to this tension for 15 min. shall show a length between the gage marks not to exceed 10 ft., 7.2 in. (6 per cent stretch).

The clamps shall then be removed and the section allowed to lie loosely on the floor for 17 hr., after which time the length between the gage marks shall not exceed 10 ft. 1.6 in. (1⅓ per cent stretch). The leather shall not crack on the grain side and the laps shall not open at the points when the belting is bent through angles of 180 deg., grain side out over forms as specified in Table IV for the different grades and thicknesses.

TABLE IV—FORMS FOR CRACKING TEST

Belt	Average Thickness Belting Inches	Diameter Form Inches
Single	Under 10/64	1
	10/64 and over	1½
Double	Up to 17/64	3
	19/64 and over	4

The leather shall not show wrinkles on the grain side (commonly called piping, and indicating looseness of fiber found in side stock or second quality belting), when bent through an angle of 180 deg. grain side in, over forms as specified in Table V for the different grades and thicknesses.

TABLE V—FORMS FOR PIPING TEST

Belt	Average Thickness Belting Inches	Diameter Form Inches
Single	All	2
Double	Up to 17/64	4
	19/64 and over	6

A sample waterproof dressed or waterproof belting, 12 in. long, shall be weighed and then immersed in water at room temperature for 5 hr. When removed from the water the sample shall be wiped and again weighed. The percentage of water absorbed shall not exceed 8 per cent. This test shall be made on every lot of 2,000 ft. or fraction thereof. The sample of waterproof belting tested for water absorption shall be again immersed in water until the total period of immersion is 24 hr. The sample, after removal, shall be allowed to dry under room conditions for 24 hr. The laps and plies shall not open when the sample is bent around the proper form as specified in Table IV.

Brains vs. Hands

By O. C. Richards

We are told repeatedly that the day of the old time foreman is past and that the successful department head of today is quite a different sort of a man from the boss of a few years ago. There is a certain type however that is met with, not infrequently, even in some of our shops that pride themselves on their progressiveness. It is the foreman who wears himself out physically. He performs with his own hands tasks that belong properly to those of others and, in so doing, fails to concentrate his efforts on the more important duty of directing those under his supervision. After being a department head for a number of years, time study and method work presents to me an opportunity for observation that is particularly interesting.

The head of a large department used to spend the first two hours of every morning personally in counting and moving parts from one section of his department to another. This work could have been done by any laborer able to read and write. Later in the day other hours were spent in other sections of the department in much the same manner. In another instance, an assistant superintendent was very anxious to get a greater production from his assembly department. For days at a stretch, he spent practically all of his time in this particular department, with hammer and wrenches, assisting in the actual assembling. The increased production from that particular bench was about the same as would have been obtained by hiring an extra man at the gate. He was the butt of the jokes of the workmen and lost much of the respect of his foremen.

Recently I was engaged in studying a job of rough, unskilled work that involved a considerable amount of handling, several men being employed on the same task. The men were very awkward, particularly in the handling, and needed the attention of their foreman to get them lined up on the job. The foreman, at this particular time, was engaged in placing castings on the benches with a hand controlled electric crane. He was busy at this for over an hour, feeling no doubt, that he was doing his best for the company.

The duties of an efficient foreman require all the energy that he possesses and he cannot afford to wear himself out at tasks that are not concerned with the management of his department. Men can be obtained at a small hourly wage to do all the things of a menial nature. It is far more profitable to take a workman off a production job than for the foreman to neglect his own duties for such things.

A foreman has, of course, a multitude of duties but certain functions stand out so prominently that he must always bear in mind the fallacy of letting anything interfere with them. A considerable amount of time can well be spent in a systematic watching of the quality of the work being produced. The quality will never be higher than the standards demanded by a foreman. A foreman with an eagle eye on the character of the work will have a wonderful effect on the product. Improvements cannot be thought of and worked out by a foreman who is trying to save the price of a day laborer. Also the instruction of new operators is something that is a real art if properly performed. Even if special instructors are assigned to teach the beginner, the foreman will be well repaid for special personal attention in getting him started off right.

A really efficient department head is very careful to keep in touch with the workmen and their troubles. He cannot afford, of course, to become so familiar that he loses the respect he must have in order to be successful. Men like to feel that their foreman is interested in their complaints and it will be found that most of the differences of opinion arising between the men and the management can be settled satisfactorily to both parties if they are taken care of promptly.

It is not an indication of laziness or false pride for a foreman to avoid actual physical labor. His hands can perform no more than one of his workmen while his brains, if he has been properly picked for his job, are worth many times as much to the management.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Carbonizing by Means of the Acetylene Torch

By Milton Wright

In the self-starting device that has become an indispensable part of the modern automobile it is the usual practice to cause the teeth of the pinion of the starting motor to enter endwise when engaging with the corresponding ring gear. The engagement is brought about by sliding the pinion lengthwise of the rotor shaft and, as this action takes place very suddenly and as the teeth of the pinion and ring gear cannot well be expected to be always in exact alignment at the moment of engagement, there is bound to be more or less interference at the ends of the teeth; resulting in rapid wear, both by abrasion and by impact.

Heat treating the pinion to prevent rapid deterioration is a simple matter, but, as the teeth of the ring gear are ordinarily cut directly upon the periphery of the engine flywheel, the heat treatment of this part is quite another matter and it thus becomes a question of making the gear a separate part and shrinking or otherwise securing it upon the fly-wheel involving complications and added expense—or of leaving the gear teeth soft. If the teeth are soft a burr will soon be thrown up by the continued engagement of the starter pinion, causing still further interference and militating against smooth and sure action of the starter.

It is not necessary, nor is it even desirable, to make the entire tooth surface of the ring gear hard, for the trouble is all at the extreme ends of the teeth. The ideal condition, therefore, is a soft tooth section with a hard surface only at the entering end. At the plant of the Locomobile Co. of America, Bridgeport, Conn., the problem has been solved in a satisfactory way by what is believed to be a unique application of the acetylene torch; devised by D. G. Roos, production manager of that company.

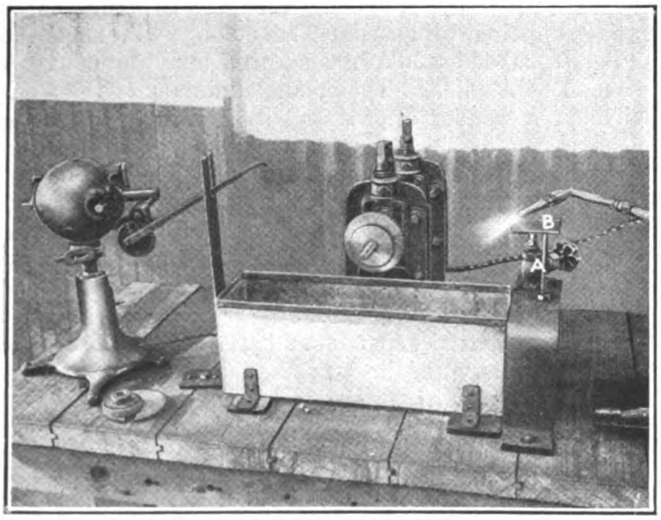


FIG. 1—DEVICE FOR CARBONIZING ENDS OF TEETH IN RING GEAR

In order to show the complete working of the method, two photographs of the device—which is at once simple and ingenious as well as effective—are here presented. Fig. 1 shows the device without the work in place and with the acetylene flame burning, while in Fig. 2 a fly-wheel may be seen in place but with the gas turned off, for if the flame had been allowed to play upon the stationary gear for the length of time necessary to make the photograph the usefulness of the part would have been destroyed.

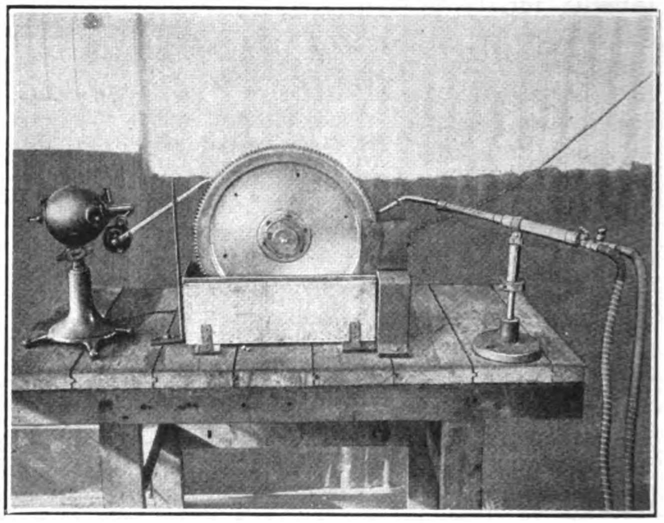


FIG. 2—THE DEVICE WITH A GEAR IN PLACE

The device consists of a standard acetylene torch, with a support to hold it in place; two ordinary shaft hangers with a short special shaft mounted in the bearings to carry the gear to be treated; a box, or trough, of galvanized sheet iron to collect and carry away the water and an electric fan motor from which the fan has been removed and a worm gear speed-reduction device fitted to the shaft to operate a pawl.

Referring to Fig. 1, water is delivered to the device through the valve at *A* and issues from a small jet beneath the platform *B* and directly below the jet of flame. With the gear (fly-wheel) in place as in Fig. 2 the flame plays directly upon the end of a tooth at the point where the latter will contact with the starter pinion and during the interval that the gear is allowed to remain stationary, only the corner of the tooth, is heated to the necessary carbonizing and hardening temperature. The pawl then operates to advance the gear one tooth and the red-hot tooth passes below the platform and stops opposite the quenching jet where it remains during the interval that the next tooth is being heated.

The object of the platform *B* is to keep the flame away from the water jet. It is but a piece of heavy sheet metal and, if corroded by the action of the flame,

is easily replaced. The sheet metal trough is for the purpose of confining the water and prevent it from splashing about. It need not (and does not) contain water, as a drain pipe immediately carries away the surplus.

As the gear is of mild steel it is necessary to carbonize the surface to be hardened, and the carbon for this purpose is already at hand in the acetylene flame. As may be seen from the appearance of the flame in Fig. 1, it is burning with a minimum of oxygen, an amount of this gas just sufficient to bring the temperature to the desired degree being supplied while the heated tooth is enveloped by the surplus carbon-carrying acetylene. A thin shell of carbonized material is thereby formed upon each successive tooth while it remains in the flame. The tooth then passes immediately to the quenching jet below the platform as the pawl advances the gear.

Once set in motion the operation of the device is continuous and automatic until all of the teeth have been carbonized and hardened. The pawl operating mechanism upon the motor shaft is so timed as to allow the gear to remain stationary for seven seconds, which time has been found by experiment to produce satisfactory results, and to consume about one second in advancing the gear. As there are 138 teeth in the gear it easily may be calculated that the output of the device is about three gears per hour, including the time of changing. It requires no attention after starting.

Crosshead Pin That Will Stay Tight —Discussion

By J. T. Towlson
London, England

On page 309, Vol. 57, of the *American Machinist*, there appeared an article under the above title by C. D. Michener. While the pin described by Mr. Michener is good in a way, I do not like it as there is no protection against sidewise movement in either direction should the pin get loose. I should very much fear to use such a pin in "out-of-sight" places, especially for fear it would become adrift as a result of endwise movement.

Retaining the idea of the split sleeve and the expanding mandrel, protection could be given to dangerous

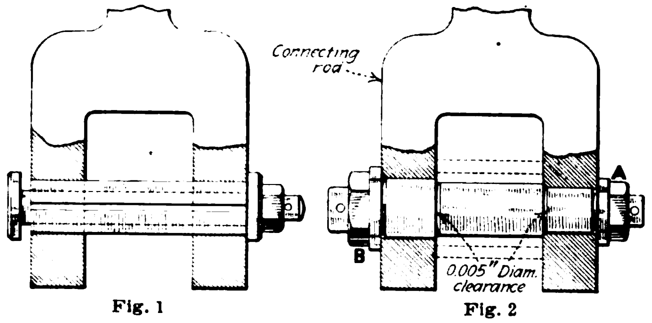


FIG. 1—MODIFICATION OF C. D. MICHENER'S CROSSHEAD PIN. FIG. 2—AN ENGLISH STAY-TIGHT CROSSHEAD PIN

endwise movement by providing a head to the expander and a washer larger than the diameter of the split sleeve for the opposite end; leaving a margin of clearance at the "head" end of the expander for tightness when required, as shown in Fig. 1.

A dependable method, adopted by engine makers with whom I am acquainted, is shown in the sketch, Fig. 2. There is, however, one essential requirement for the success of this device, which is not shown in the sketch. It is this: The pin is of chrome-vanadium steel, with all diameters ground to a glass surface. The bore of the connecting rod is bored under size, corresponding to an allowance for a hydraulic pressure fit. The pin, greased with lard oil, is pressed in by hydraulic pressure and then pressed out again by the same means, the useful effect being to burnish and harden the fitting surfaces of both the pin and the hole in the rod.

In assembly, the pin is pulled in by means of the nut *A* and is withdrawn by the nut *B*, the closing in of the jaws of the rod being prevented by the crosshead being in place. A pin so fitted will stay tight, while the center part on which the crosshead brasses wear may be shimmed up when elliptical wear takes place.

Limitation of Piston Aligning Gages —Discussion

By Stanley W. Mills

Under the above title on page 659, Vol. 57, of the *American Machinist* J. T. Towlson criticises the conventional type of gudgeon or wrist pin used in the gasoline engine and suggests a design of ball socket in the piston as a substitute. Both his criticism and suggested improvement are distinctly open to argument.

In the first place, his proposal, entirely apart from the number of parts and consequent complications, involves just as much, if not greater, accuracy in manufacturing as the conventional type of pin bearing in bosses at right angles to piston axis. The removable socket or pad which he shows is in itself a costly piece to make and could not be successfully machined without a great deal of care. It would be a costly and difficult problem to machine the ball end on the rod in line with the large end, without the use of expensive and accurate fixtures and it should be obvious that if the slightest errors exist in the finished pieces, the rod would be cramped when in position in the engine and inevitably cause trouble.

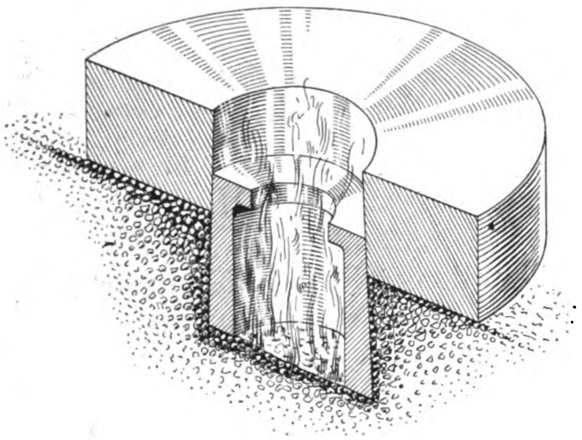
I venture to dispute Mr. Towlson's statement that with a ball socket, the rod is tractable in all directions, unless the greatest accuracy is maintained with respect to concentricity of the socket with the piston, correct alignment of the ball with the large end of the rod and the position of the cylinder on the crankcase. There are other details which I feel would never work out in practice, such as the inadequate means for locking the cap, the objectionable feature of drilling the piston skirt in order to insert the lock screws and the apparent impossibility of assembling the adjustable cap unless made in halves, which would be an impractical construction.

It is of course a fallacy to adhere blindly to past practice just for the reason that that is the way it has always been done. On the other hand, however, a time tested construction such as the conventional form of wrist pin (which in essentials has not been changed since gasoline engines were first produced) is undoubtedly based on a sound foundation. I can state positively that today the straight type of wrist pin, either floating in both rod and piston or clamped in one and bearing in the other, represents the best, most modern, and fool-proof design.

Closing-In Small Round Dies

By P. L. Stohr

Small round dies that have become worn oversize in service can be reclaimed with very little trouble by the following simple method. Bore out a casting, as shown in the sketch, to a drive fit for the die and drive the die into it for a short distance. Lay the die and casting on



CLOSING-IN SMALL ROUND DIES

the forge fire so that the flames will draw up through the hole in the die. As the die becomes heated in the center long before the larger casting, the expansion of the metal will close in the hole and when the casting has become hot the die will drop out into the fire; when it is ready to be hardened in the usual way.

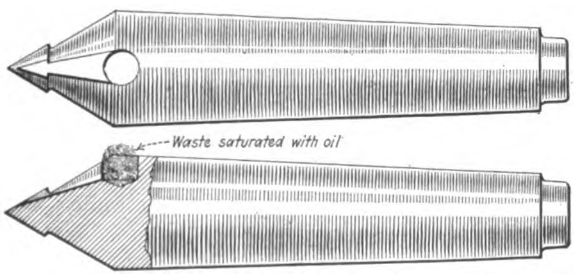
The hole will usually be found so much smaller than before as to require regrinding to size.

Saving Time in Grinding Centers —Discussion

By W. H. Storey
West Croydon, England

Under the above title on page 234, Vol. 57, of the *American Machinist*, Charles Kaufmann illustrates a center which is certainly a time and grinding wheel saver.

Personally I cannot understand why centers are turned solid as they usually are, presenting to the grinding wheel a face of about 1½ in. of which usually



TAILSTOCK CENTER WITH OIL GROOVE

less than ¼ in. is used. I found grinding such centers to be a great waste of time, particularly when using a small portable grinder attached to the lathe carriage, and so I had all the centers in the shop cut away identically as shown by Mr. Kaufmann, but, in order to make a further saving in grinding by eliminating it as far as possible, I had a lubricating groove cut out in the tailstock center as shown in the illustration.

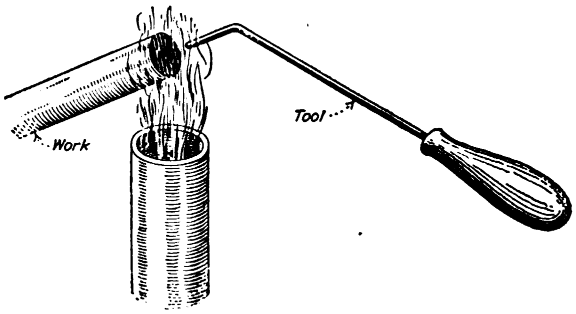
In the top portion of this groove, which is countersunk by means of a drill, a small pad of cotton waste is kept. The waste is saturated with oil which slowly drips right on to the point of the center. If insufficient oil is dripping, all the operator has to do is to press the waste slightly with his finger, forcing a little of the oil out.

A center made with an oil groove as above described will eliminate the necessity of the constant use of an oil can or any of the other usual means of lubrication. Moreover such a center is not liable to be burned, even through the inattention of a careless operator.

Tinning Small Holes

By E. Lytton Brooks
London, England

A piece of copper wire that will easily float or move about in the hole is bent at one end slightly longer than the depth of the hole; cut off about 6 in. long and handled. A piece of round wood or small file handle serves nicely. The work is then heated in the gas flame with solder and flux in the hole, and the copper wire end moved about in it until the inside of the hole



WIRE FOR TINNING SMALL HOLES

is tinned. The copper wire becomes tinned almost immediately and behaves like a small soldering iron. For electrical work paste and acid fluxes should be strictly taboo.

Storing Dies, Jigs and Fixtures

By S. N. Bacon

Wooden shelves for storing heavy punches and dies, jigs and fixtures are uneconomical due to wear and breakage and the standard adjustable metal shelving will be found to be more satisfactory in every way. The usual practice seems to be to locate the heaviest tools on the shelves nearest the floor and the lightest tools on the top shelf. While this method makes use of all possible shelf space a better arrangement and one which facilitates the transfer of tools to the machine and back to shelving is to locate the heaviest tools upon a shelf the same height from the floor as the bed of the machine upon which the tool is to be used. A truck of the proper height should be used and if constructed of wood, the top should be covered with sheet steel without seams or rivet heads, thus providing for sliding the heavy dies and fixtures from the shelf onto the truck and from the truck to the bed of the machine. The shelves below as well as above are used for storage of light and medium weight tools only.

Making Small Shoulder Studs in Double Lengths

By K. H. Crumrine

A line drawing of a shoulder stud of a design commonly used in machine and tool construction is shown in Fig. 1. Many such studs are made on lathes or screw machines and are used without being ground. Others, however, are required to be ground on all diam-

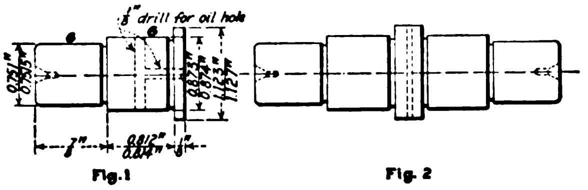


FIG. 1—THE STUD TO BE MADE. FIG. 2—TWO STUDS MADE IN ONE PIECE

eters, and many must be hardened before grinding. Studs of this type, when made in single lengths, present certain difficulties in grinding. One difficulty is that the distance between the grinding centers is so short as to make it hard to grind the pieces straight. Another difficulty is presented in holding the studs by the short heads for driving, so that both of the principal diameters can be ground at the same setting. In view of these difficulties in grinding when made in single lengths, the double length method as used in our shop may be of interest.

The stud shown in Fig. 1 must be hardened and ground on the two smaller or principal diameters and the shoulder under the head must be hard. The stud is made of low carbon machinery steel and carbonized preparatory to hardening. Pieces long enough to make two studs as shown at Fig. 2 are cut off, allowance being made for the parting tool, plus the usual amount necessary to finish the ends. The stock used must be larger than the largest diameter of the stud by an amount sufficient to permit all carbonized metal to be removed from the diameter of the heads after the pieces are carbonized. Next the pieces as cut are centered, the ends squared up in a universal chuck on a lathe or in a collet on a screw machine, the two smaller diameters turned to grinding size and the grinding recesses cut in. The heads or largest diameters of the studs must not be turned at this time but left as large as possible until after carbonizing.

The studs are now ready for carbonizing but after this process are not immediately hardened. Instead they are returned to the machine shop where the excess material is turned off the heads and the cross holes drilled. Turning the carbonized material from the large diameter makes it impossible to harden the heads except under the shoulders and leaves the heads in suitable condition to be cut by the parting tool at the proper time. If the cross holes had been drilled previous to carbonizing, their surfaces would have been carbonized sufficiently to harden and would have made it extremely difficult to drill into for the small oil holes in the ends which are put in later. Next the studs are heated and quenched for hardening and are then ready to grind. Although the double length method of making these studs provides a most convenient way to drive for turning it is in the grinding operation that the value of this method becomes most apparent, as each stud can be completely ground at one holding, being driven by a dog attached to the stud on the opposite end.

After grinding, the studs are ready to be separated and for this operation are cut with the usual parting tool. Next the ends are finished and a spot made in which to start the drill for the small oil hole in the end. The oil holes are drilled in a high speed drilling machine in a separate operation. Should the number of studs required be large, they are made from the bar in a screw machine. A stud is made and centered as usual, but instead of cutting off to length, enough stock is fed out and cut off to make another stud on the opposite end as a second operation. After this the procedure is the same as for the smaller lots.

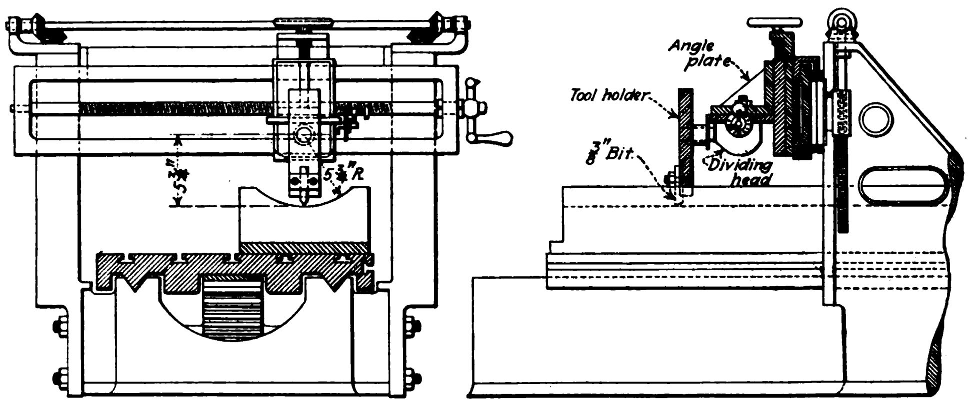
Radius Planing With a Dividing Head

By Robert T. Wilson

The sketch shows how a job of radius planing was done on an ordinary planer by the use of a dividing head from the milling machine, and without a great deal of extra rigging. This adaptation was made and the work done in this way for the reason that we did not have a lathe or boring mill large enough to handle the piece.

The clapper box was removed from the vertical slide of the planer and an angle plate bolted in its place, thus giving us the advantage of the regular vertical feed. The dividing head was secured to the under face of the angle plate with the spindle parallel to the planer table. A piece of cast iron was bored and threaded to screw on the spindle nose of the head in place of the regular chuck or driving plate and at the end of the piece a radial groove of square section was made to accommodate a commercial tool bit, which was held in place by a clamp and stud bolts in much the same way as a planer tool is ordinarily held.

By setting the point of the tool to the required radial distance from the center of the spindle the radius was planed by feeding the tool at the end of each stroke of the planer table by means of the regular index crank on the dividing head. The casting had been cored to approximately the desired shape and we were thus able to remove the amount of metal necessary to secure a good finish.



RIG FOR RADIUS PLANING

Thread Milling Cutters and Hobs

By A. Nugent
Cork, Ireland

A consideration of the elements of the square thread and the modern method adopted for producing it by the process of milling, is helpful when considering the production of circular cutters for this purpose and also the production of hobs for splining and for square and hexagon shafts and kindred work.

Examination of the sketches will show that the annular spaces around the periphery of a cylinder, Fig. 1, and the longitudinal cuts shown in end view, Fig. 2,

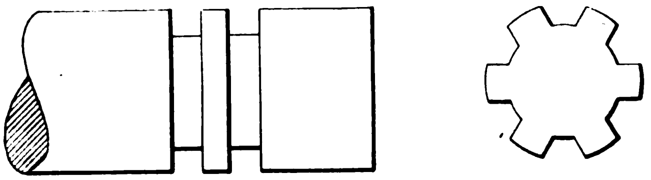


FIG.1 FIG.2

FIGS. 1 AND 2. EXTREMES OF SQUARE THREAD SECTION

are essentially two extreme forms of the square thread. In Fig. 1 the helix angle is zero and in Fig. 2 infinity. The square thread screw then, in all its wide variations of lead, pitch and diameter, is logically some intermediary between these two extremes.

Once we depart from the conditions of the annular spaces Fig. 1 in the direction of the conditions shown in Fig. 2, the helix angles, which for the top and bottom of the thread alike are zero in the first case immediately become two different dimensions, both varying as the lead of the thread.

If we lay out a square thread to a fairly large scale and superimpose the outline of a side and face cutter of a width equal to half the pitch we will see that such a cutter could not produce a thread whose longitudinal section is a true, or approximately true, square.

The deformation is due to the interference of the

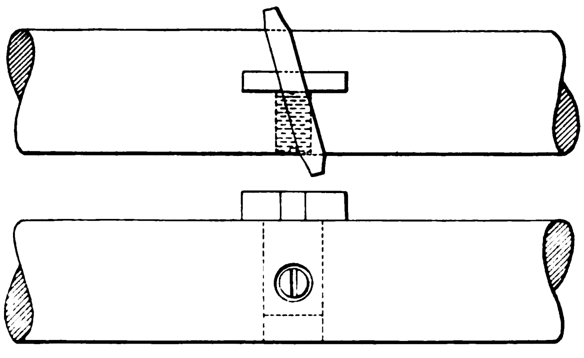


FIG. 3. SETUP FOR OBTAINING THE FORM OF CUTTER

sides of the cutter with the spirally disposed side of the thread as it enters and leaves the cut. The amount of this interference will increase with the diameter of the cutter, the depth of cut, and the lead of thread, for a given diameter of blank.

The true form of cutter for milling a square thread is therefore not of the standard rectangular side and face cutter form but one whose teeth have a curved outline, which curve does not conform to any of the regular curves and is only strictly true for one particular lead, depth of cut and blank diameter of screw.

While it is possible to arrive at this correct curve graphically, such a method involves complex geometrical projection and is in fact of little use to the toolmaker, even when done with the greatest care. The better and more practical way is to generate the desired curve by setting up the machine as though for milling the actual screw, then by mounting on the cutter arbor a blank made of some free cutting metal, such as white metal, we may slowly feed astride this rotating blank a line form tool of the thread space Fig. 3, held in an arbor placed between the work centers of the thread milling machine. An appropriate curve is thus accurately generated which can be afterwards transferred to a tool steel cutter blank by means of carefully made male and female transfer gages and a form relieving tool.

In the case of the generating of splines, this is done on a gear tooth hobbing machine, the basic principle of which is that of a gear (which is the work blank) rolling into a rack (which is the hob), and the natural, mutual alliance between these two members is the regular involute curve.

We have seen, however, in the case of splining that we are fundamentally generating an extreme form of

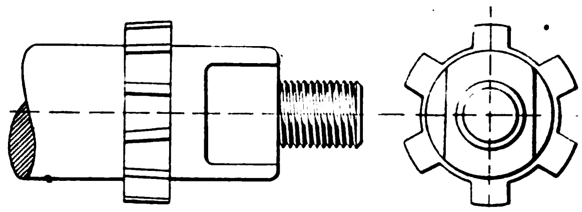


FIG. 4. SHAPE OF CUTTER FOR SPLINED SHAFTS

square thread whose sides consist of straight lines parallel with each other and with a radial line drawn through the center of the thread. In this case the action between hob and work is not rolling contact and requires a hob with a special form of tooth made to a given size and number of splines and a given blank diameter.

We can best arrive at this true form by setting up the hobbing machine as for splining the actual shafts and placing between the work centers a cutter, Fig. 4, whose cutting outline conforms exactly to a cross section of the splined shaft desired. On the hob spindle we then mount a hob blank, previously threaded approximately to the one desired as to pitch, depth of cut and diameter, but made from some free cutting metal as previously indicated, and left sufficiently long to span the arc of contact between itself and the cutter.

The cutter, Fig. 4, will then generate the true shape of hob tooth. By transferring this shape to gages we have a permanent means of reproducing accurate form relieving tools for repeating any further hobs that may be required for that particular size of splined shaft.

Another modern application of the hobbing machine is to the generating of shafts having square, hexagon and other symmetrical sections but which, like the splined shaft, have not the rolling contact relationship involved when hobbing involute gear teeth. In these latter cases hobs with special tooth forms are necessary, and are best arrived at as indicated in the case of splining hobs.

In designing these hobs it should be noted that the normal pitch of the hob must correspond with the circular pitch of the splines, or, in the case of squares or hexagons, with the circular pitch of the points of the cross section. On this account by varying the hob diameter we can, within limits, determine an axial pitch of our hob which will greatly convenience the toolroom when making it. This is evident when the axial pitch of hob $= P$, pitch of splines $= S$, and helix of hob $= A$ degrees. Then: $P = Sx$ secant A.

Editorial

WE WOULD GLADLY invest a hundred dollars if we could be certain that we would get ten thousand in return. Our enthusiasm would still be considerable if we got only one thousand or five hundred or even two hundred. But when it comes to production in the shop we seem to have the idea: ten thousand, or nothing. Just because the profit is not so great we refuse to employ the automatic machine for smaller quantities; we seem to feel that, if it takes three hours to set up the machine, we must gain at least a hundred. Why not take paper and pencil and figure it out?

Standardizing Names of Machine Parts

THERE SEEMS to be no question that the work of standardization which has been going on more or less spasmodically is taking definite root and that we are to have workable standards for many machine parts.

There is, however, a great need of standardization along a line which is too generally overlooked, namely, the standardizing of the names of machine parts, particularly those which are widely used in general machine construction. Take for example, machine screws and bolts with their variety of heads. There is not even an accepted definition as to what a machine screw really is, and when it comes to the shape of the head or the length of the thread we are all at sea.

We heartily approve standardization along rational lines, and we sincerely believe that a standardized nomenclature is of prime importance.

Grinding Machines and Some of Their Problems

THE INCREASING use of grinding as a method of machining metals of various kinds emphasizes more and more the problems which confront both the makers of grinding wheels and grinding machinery, and those who use them in finishing their product. The varying conditions of wheel contact introduce elements which require careful study, but which are too often overlooked by those who see the matter from a superficial standpoint.

A little study of the amount of contact between wheel and work on both internal and external cylindrical grinding, with various sizes of work and of wheels, will soon show the necessity of having various grades of grinding wheels even for the same materials. When it comes to surface grinding it is only necessary to study the entirely different conditions when using the periphery of a narrow-faced wheel or when grinding with a large ring wheel on a surface having considerable area. Here the problem of a continuous or a broken surface must also be met and the wheel selected in accordance with the work.

Then, too, there is the problem of the way in which the grinding-wheel spindle fits its bearings, and the effect of heat in tightening these bearings or in making them more free. In too many cases the wheel spindle bearings receive much more careful attention than the mounting of the work to be ground, and there are doubtless many instances where more perfect work could be secured if more attention were paid to this end of the operation. There is a growing tendency toward wide wheel work and toward more simple machinery.

The whole problem is one of much interest and in which there is ample opportunity for improved design and construction, as well as for skill and experience on the part of the operator.

The Growth in the Number of Aircraft Industries

THOSE WHO FAIL to realize what has actually been done in airplane development and use, and think of it only as a future possibility, are not only lagging behind the procession but are likely to miss considerable business from time to time. For while the output of airplanes is insignificant as compared with the automobile as yet, there are nevertheless several thousand men engaged in the industry which is already providing a market for a large number of machine tools of the higher grades.

As an indication of the activities already under way it is only necessary to note that 72 firms engaged in the manufacture of materials, parts, accessories or supplies are members of the Aeronautical Chamber of Commerce, the national body which embraces nearly all the concerns engaged in airplane development. As an example of the way in which the airplane industry affects other fields, one large concern has made a comprehensive study of metals for airplane work and as a result is supplying the bulk of the bearings for the new airplane motors and also for replacements at the various flying fields.

Machine builders of all kinds will do well to give more attention to the airplane to aid in its development. One of the ways to help this development is to work for suitable landing fields in every city, as these must precede the commercial use of planes on any large scale. Those who are in a position to profit by the development of aircraft should lose no opportunity to put their shoulders to the wheel while the industry is still young and help to educate the public to its possibilities.

Just Suppose

JUST suppose you were an old engine lathe in a railroad shop and that you had been working hard for forty years. And suppose you had rheumatism and St. Vitus' dance and every move you made was agony and you couldn't do your work the way you used to so that your self respect was gone.

You'd give all you possess to have the superintendent come around some day and order you put on the scrap pile so that your miserable existence could be ended.

Railroad shop superintendents don't do humane things like that? Of course they don't, the management won't let them, but—

Just suppose.

Shop Equipment News

Bullard Continuous Turning Machine

The Bullard Machine Tool Co., Bridgeport, Conn., has recently added to its line of vertical machines, the newcomer being the continuous turning machine illustrated in Fig. 1. The turning machine maintains the Bullard characteristics in being vertical, in the use of multiple tools which turn, bore and face without the use of form or sweep tools and in the use of tool slides with large bearing surfaces, of simple tools which are easily adjusted and of flood lubrication to all working surfaces. While at first glance the machine may be likened to the Mult-Au-Matic, it is a distinct departure from it in a number of ways.

As the name implies, the machine is of the continuous instead of the station type. In the latter the tools remain stationary and the work tables are indexed under the different tool heads for each operation. In the former, both the work and the tool head move continuously around the center column and all indexing is avoided. Each operation is performed in less than one revolution of the carrier, a portion of its revolution being reserved for loading the work in the chuck. In the machine shown the loading time is a trifle over one-fourth of the cycle.

The continuous turning machine is built around a central column, which carries the motor at the top, and just below it the single cam that actuates and times all the tool slides. Everything below the cam revolves around the central column, the work tables being revolved under the tools except during the loading period. A shaft in the center of the column drives a large ring gear, which in turn drives each work table by meshing with a gear larger than the table itself. The gears are automatically engaged and disengaged as in automobile transmissions without the use of clutches. The large carrier which supports the work tables and carries them around the central column is driven by a large wormgear, also actuated from the central power shaft. The speed of the carrier can be varied by changing a single pair of gears, no gear box being necessary.

The detailed view, Fig. 2, gives a good idea of the construction of the tool heads and the work they do. The work shown is a tractor flywheel, weighing about 140 lb. in the rough, this being the first operation. The wheel is held on the inside by the chuck jaws, the piece being chucked during the part of the cycle when the work table is idle. The tool at the left rough turns the outside; those at the right feed toward the center, facing both sides and chamfering the corners after the face has been turned by the tool at the left. The side movement is secured by rack and pinion from the vertical slide.

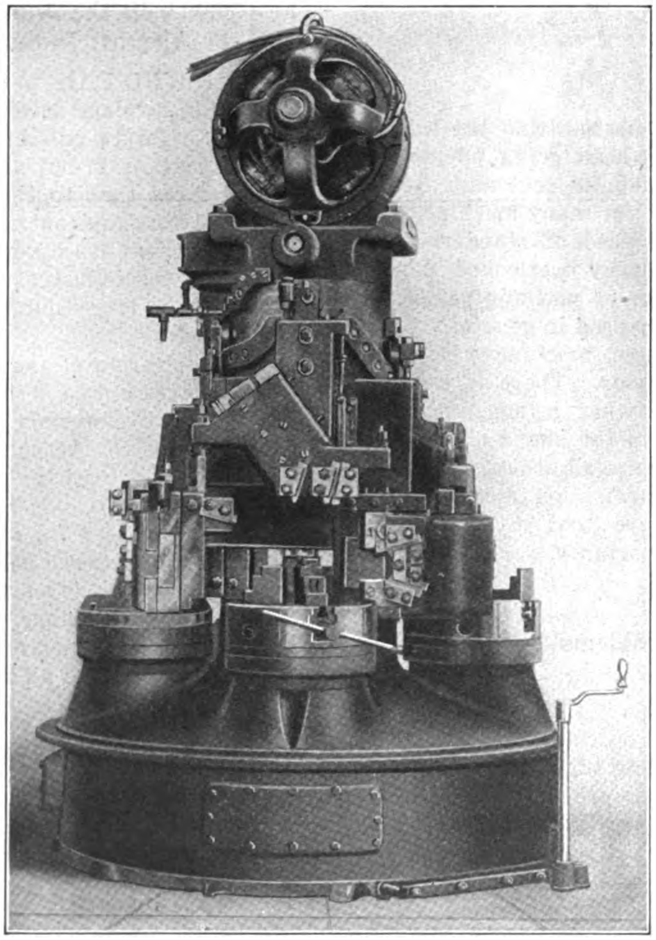


FIG. 1—BULLARD CONTINUOUS TURNING MACHINE

At the same time, the tools in the central tool slide feed straight in to the work as far as the stops permit and are then moved toward the left by the angular slide as the main slide continues to be forced down by the cam at the top. These operations take approximately three-quarters of the revolution of the carrier, the amount being determined by the work being done. The tools are withdrawn and the table stopped when it reaches the loading position. The piece is removed and another put in its place, ample time being allowed for this work during the idle period.

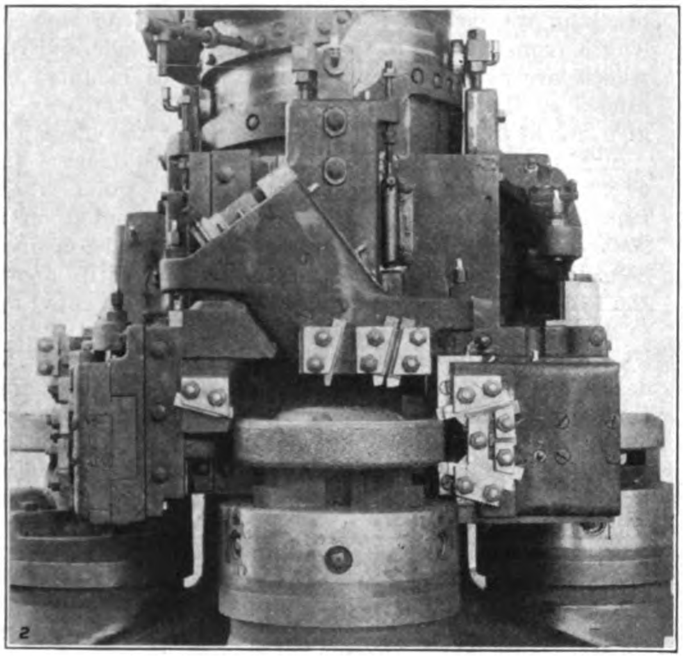
In the meantime the second operation is being performed by the next tool head, as shown in Fig. 3. As soon as this head reaches the loading point, the finished wheel is removed and the one just rough turned on the first spindle is turned over and chucked as shown. In this operation the machine bores and faces the inside of the wheel at the hub, only three tools being used. Here again the tools are held in the angular slide, which feeds straight down to the work until stopped by the adjusting screw stops at each side. The continued movement of the main slide forces the tool head to the left, thus facing the hub. The view shows also the small oil dash-pot at the right of the main slide to cushion the movement of the slide as it drops down the steep part of the cam. The retarding or dragging action on the tool slide prevents digging in of the tools. The illustration likewise shows the construction of the tool slides, the size of which can be estimated by comparing them with the work table, which is 18 in. in diameter.

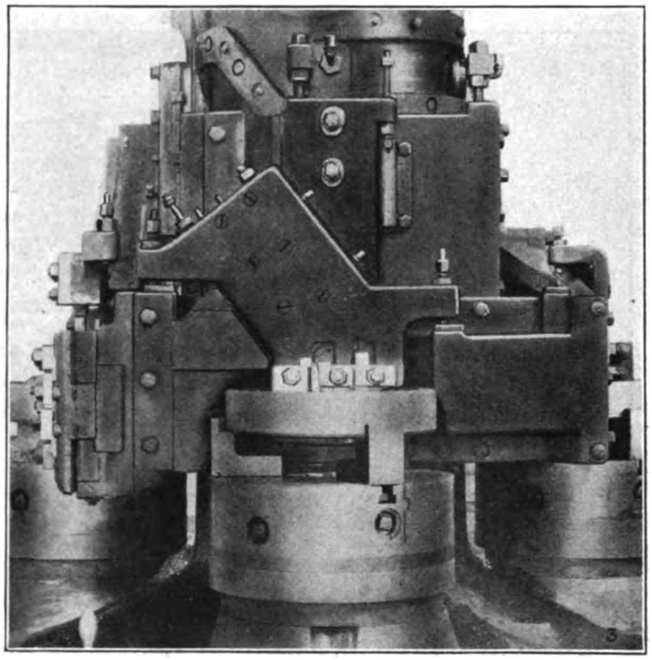
The third operation is also on the inside of the flywheel, this operation being the finish boring, facing

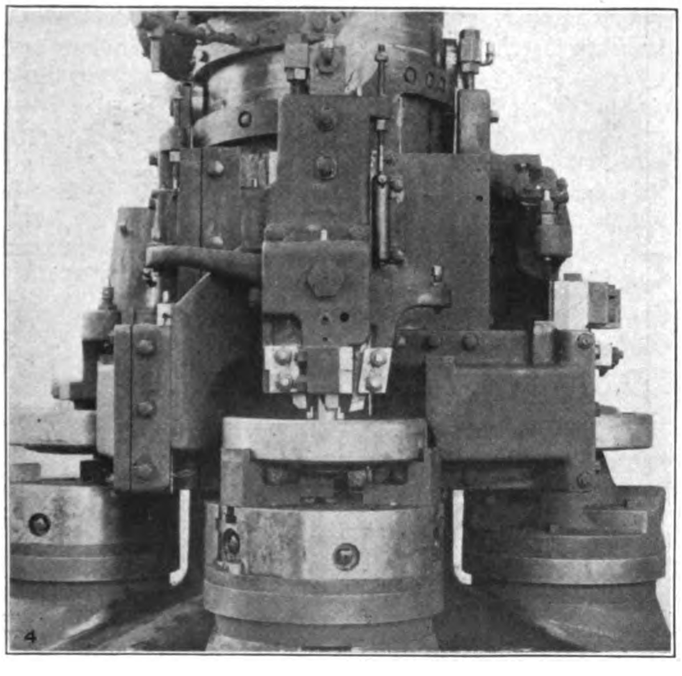
and chamfering, as in Fig. 4. The tool slide has only vertical movement, and the illustration shows the sharp drop of the cam and the large diameter of the cam roller. Fig. 5 shows the finishing operation, which resembles the first as far as the tooling is concerned. The wheel, however, is driven by a central mandrel instead of a chuck, so as to insure the rim being true with the bore. When the wheel is finished it weighs 115 lb., as about 25 lb. of metal is removed in machining.

gear is not a driver, but is merely to insure the quiet and easy meshing of the driving gear when the table reaches the point for beginning its work.

The upper gear is constantly in mesh, while the driving gear drops out of mesh with the central gear when it reaches the loading position, under control of a cam in the base. When the cam again raises the driving gear to start the table, the friction plate on its upper surface contacts the upper gear and brings the driving







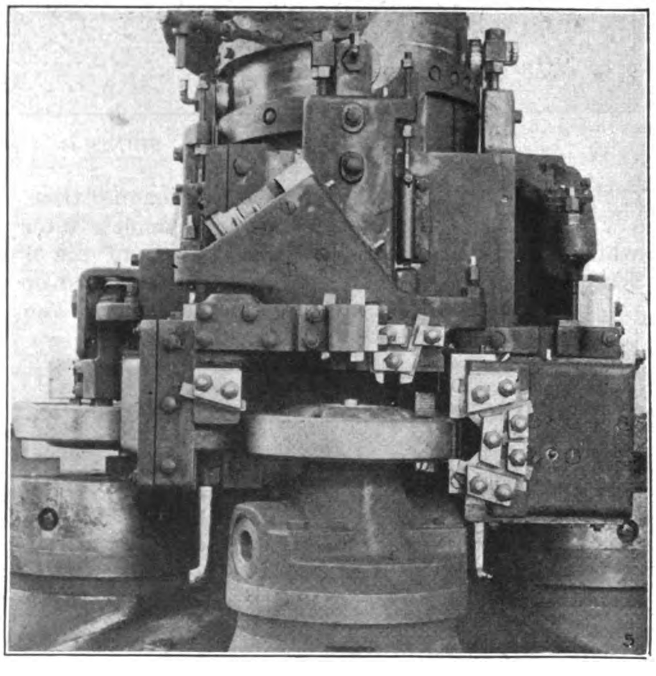


FIG. 2—FIRST CUT ON FLYWHEEL. FIG. 3—BORING AND TURNING THE INSIDE. FIG. 4—FINISH BORING. FIG. 5—FINISHING THE OUTSIDE

A view of the central column around which the carrier revolves with its work tables and tool heads is shown in Fig. 6. The power shaft is shown in the center of the column, and toward the bottom the gears which revolve the work tables. Below the gears is the bearing for the carrier. The work table spindle and its bearing, on the right of the illustration, show a detail of the construction used. The upper or narrow-faced

gear up to speed before the cam throws it into mesh with the central gear. The view shows also the length and diameter of the work table spindle, with its bearing at each end. The upper bearing is 7 in. in diameter on the straight portion and 12 in. at the top of the angle.

This machine has been designed to handle work too large for the Mult-Au-Matic, and where a simple, massive machine can secure maximum production with a

minimum of training on the part of the operator. Perhaps the best idea of its simplicity may be had from the fact that it contains but 225 parts, exclusive of the chucks. The largest diameter is 68 in. and the height to the top of the oil piping is an even 10 ft. The weight is 23,500 lb. The machine is so designed that no special foundation is required. It is equipped with a 30-hp. motor, but the maximum used in turning the flywheels shown was about 7 hp. and with the machine running idle about 2 hp. The time of the complete

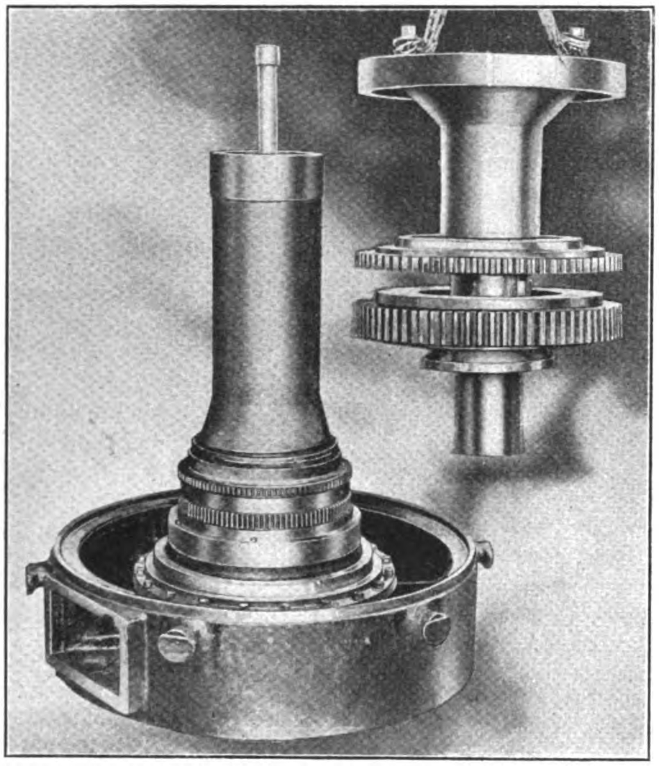


FIG. 6—COLUMN AND ONE TABLE SPINDLE

cycle was 4 min., of which 70 sec. was loading time.

The oiling system includes a very complete filter in which the oil goes first to the underside of the filter screens, so that any solid particles in the oil drop to the bottom and do not tend to clog the filter. The oil to the bearings is piped direct from the filter.

Racine Portable Duplex Bandsawing Machine

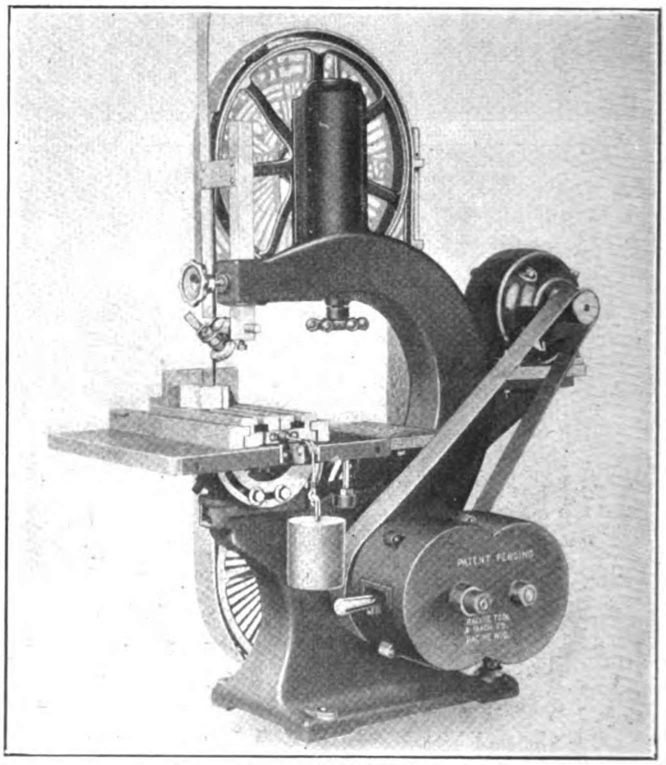
A small portable bandsawing machine of the duplex type for cutting both wood and metal has recently been placed on the market by the Racine Tool & Machine Co., Racine, Wis. The machine is suitable for use in toolrooms, pattern shops, trade schools and places in which light wood and metal cutting need be done.

The accompanying illustration shows the drive side of the machine as fitted for metal work. A 1/4-hp. induction motor running at 1,750 r.p.m. furnishes the driving power. It is attached to a convenient lighting circuit by a flexible cord, a feature that adds to the portability of the machine. The platform on which the motor is bolted is an integral part of the main frame. The frame provides a capacity from the throat to the blade of 14 in. The capacity between the table and the guide is 5 in. and between the metal-cutting vise and the guide 3 inches.

The wheels carrying the saw blade are of cast aluminum 14 in. in diameter, with the rims machined and covered with rubber bands. They run on ball bearings mounted in grease-packed housings whose positions are easily adjustable. A hand screw is provided to tilt the upper wheel to properly align the blade. The tension on the blade is controlled by a hand screw operating against a spring, so as to give a cushioned tension. The spring serves as a safety device; if chips accidentally fall between the blade and the lower wheel, they will pass around the wheel without breaking the blade. The saw blades used can vary in length from 7 ft. 6 in. to 8 ft. Both the blade and the wheels are protected by aluminum guards mounted on hinges so that they can be swung out of the way to give access to the wheels when changing the blade.

The saw guide is adjustable for blades from 1/8 in. to 5/8 in. in width and of any gage. The guide wheel runs on ball bearings. The guide is mounted on a square steel post and is easily adjustable to the desired height. The table is 15x15 in. in size and 16 in. above the bench on which the saw stands. It can be tilted up to 45 deg. and clamped in any desired position.

A two-speed attachment can be provided when it is desired to use the machine for both wood and steel, the change being accomplished by the shifting of one lever. The slow speed enables cutting sheet steel and flats up to 1/4 in. without the necessity of clamping in a vise. For bar stock, rounds, flats, and shapes up to 3 in.



RACINE PORTABLE BANDSAWING MACHINE

in thickness, the gravity-feed vise can be furnished. The vise is fitted with a quick-acting cam lever to aid in holding material of various shapes. It can be easily bolted to the table and removed. A pedestal 22 in. high can be furnished.

The machine has an over-all height of 39 in. and requires a floor space of 34x17 in. when plain and 34x21 in. with the two-speed attachment for metal cutting. The weight of the plain machine is 200 lb., while equipped with the vise and two-speed transmission for both wood and metal cutting it is 285 pounds.

Thomson Type SP Butt Welding Machine

The Thomson Electric Welding Co., Lynn, Mass., has recently brought out a line of butt welding machines in which appear a number of changes from the former designs, and which are especially adapted to making the so-called "flash" welds.

The platen to the left, which has heretofore been gibbed to the bed and capable of adjustment by means of a screw back-stop, is made rigidly a part of the machine frame. The movable platen is made of cast iron and is much longer in proportion to its width than heretofore, thus insuring a free moving slide.

In the smaller machines the pressure to effect the weld is applied to the movable slide by means of a hand lever and toggle joint through a right-and-left threaded pitman and adjusting nut similar to the pitmans of many punch presses. This combination provides a wide range of adjustment for position of the movable platen, and at the same time enables the operator to apply the maximum welding pressure as the toggle straightens out, thus relieving him of the necessity for severe exertion. In the larger sizes the pressure is applied by hydraulic cylinders.

Primary windings for the transformers may be supplied for any standard voltage from 110 to 550, and for frequencies of 25 and 60 cycles. A five-point regulator switch mounted on the base of the machine controls the flow of current. The secondary coils are flexible, being made up of laminated copper strips firmly clamped to the terminals. The secondary terminals themselves are heavy castings of copper, bolted to the ends of the respective platens, where they form the parts to which the work-holding fixtures are directly attached. This construction eliminates the necessity for platens of solid copper and for sliding electrical contacts.

The transformers are of the open type of ample cross-section to carry all normal currents without resistance heating, and are air cooled. The terminal castings and the platens are chambered and fitted with connections for water circulation to prevent undue heating, by radiation and conduction from the work. The work-holding clamps are of the vertical type and are ordinarily operated by hand levers. Pneumatically operated clamping devices may be furnished if desired, and the machine shown herewith is so equipped.

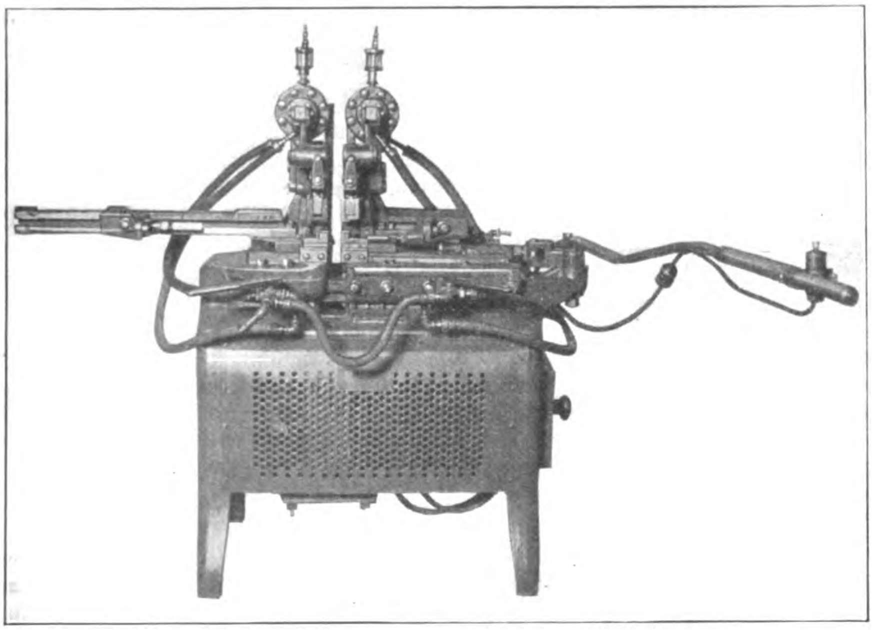
The SP machines are lighter for a given capacity than are those of the older type, yet they are stronger and show a higher electrical efficiency. They are built in five sizes, the smallest having a welding capacity ranging from a rod $\frac{3}{16}$ in. in diameter up to 1 sq.in. in cross-section, while the largest one welds work having cross-sectional areas from $\frac{1}{2}$ to 20 square inches.

Amsler "Elastic-Column" Dynamometer for Hardness Testing Machines

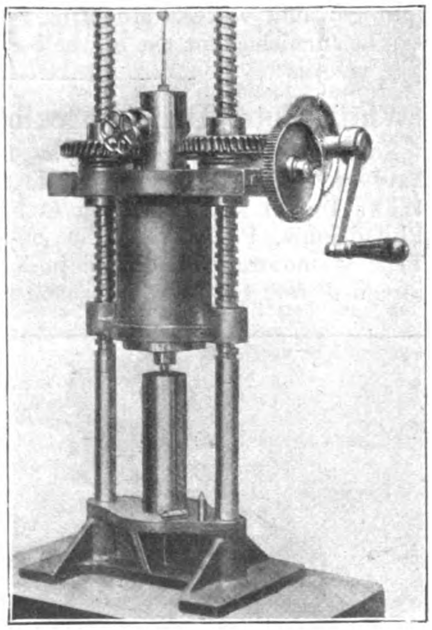
Holz & Co., Inc., 17 Madison Ave., New York, N. Y., have recently placed on the market a line of hardness testing machines employing an "elastic-column" dynamometer and made at the Amsler works in Switzerland. The elastic-column dynamometer is an apparatus employed for measuring and indicating the load exerted by machines that are not used for producing a fracture of the material under test, but rather static deformation with definite predetermined pressure. It is suitable for hardness testing by either the Brinell method, in which an impression is made in the work by means of a small ball, or by the Ludwik method, in which a cone is employed for a similar purpose.

The accompanying illustration shows a small-sized hardness testing apparatus of this sort with the elastic-column dynamometer incorporated in it. The apparatus forms the upper part of the press. The member carrying the ball or contact point is secured to a plate at the bottom of the housing. The total load acting on the test piece is then transmitted by means of several steel bars or short columns in the cylindrical housing. The reaction is born by the upper part of this housing, which is connected to the platten of the machine so as to support the work from below. The deformation of the columns due to the compressive stress is always proportional to the load that they are sustaining. Since the columns are loaded far below their elastic limit, they do not undergo permanent deformation.

In the center of the load-supporting column is another



THOMSON TYPE SP BUTT WELDING MACHINE



"ELASTIC-COLUMN" MACHINE

column that is not subjected to stress. It supports a small piston that moves in a space filled with mercury. Consequently, when the supporting columns are shortened under load, the central piston moves up in its mercury space a distance equal to the shortening of the columns, thus expelling a quantity of the mercury into the capillary tube shown on top of the housing. The quantity of mercury expelled is proportional to the load placed on the work.

A micrometer screw, the end of which is immersed in the mercury, is employed to measure the amount of mercury that has been expelled into the tube. The level of the mercury can be adjusted to any desired height by turning the screw. Thus, after load has been applied, the level of the mercury can be brought back to the point at which it stood before the load was put on, and the amount that the screw is turned may be used as a measure of the load applied. If it is desired to apply a definite load with the machine, as, say, 3,000 kilos, the micrometer screw is turned back three complete revolutions and then the load gradually increased until the level of the mercury returns to its original height. The reading of the load is thus independent of the bore of the capillary tube, so that in case of accidental breakage, the tube can be replaced without influencing the accuracy of calibration.

While the dynamometer is sensitive, it is at the same time of very rugged construction. It can be overloaded only when the testing machine itself is being wrecked. The dynamometer is calibrated by dead load up to its full capacity, and the calibration can be checked at any time by hanging the machine up by the compression plate, the load then shown agreeing with the weight of the machine.

The dynamometer can be mounted in the testing machine in different manners. In the illustration is shown a ball-type hardness testing machine having two speeds. The fast speed enables bringing the ball quickly to the required position, and the slow speed is used to apply the load. The machines are driven by hand levers and are not of the hydraulic type.

With the simple wormgear drive employed there is but little that can get out of order, or be deteriorated by the action of dust and soot such as encountered in heat-treating shops and which is apt to find its way into hydraulic valves. Mountings, both large and small, can be furnished for use on the bench or the floor.

White Motor-Driven Flexible-Shaft Outfits

Small portable motor-driven flexible-shaft outfits have recently been placed on the market by the S. S. White Dental Manufacturing Co., 211 South 12th St., Philadelphia, Pa. The $\frac{1}{16}$-hp. outfit equipped with a Type W motor is illustrated in Fig. 1. The motor is intended for 110-volts alternating or direct current,

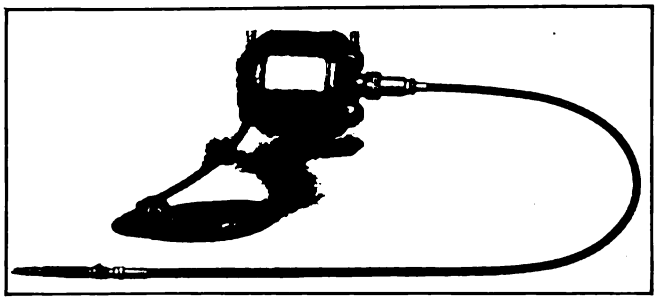


FIG. 1—WHITE TYPE W PORTABLE ELECTRIC-DRIVEN FLEXIBLE-SHAFT EQUIPMENT

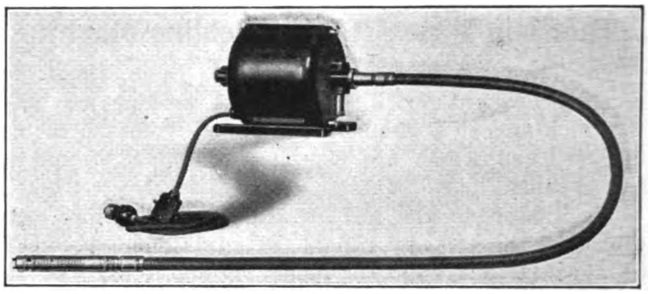


FIG. 2—WHITE TYPE Y FLEXIBLE-SHAFT OUTFIT

and runs at a speed of 3,450 r.p.m. An attachment cord and plug and a push switch are furnished. The flexible shaft is fastened directly to the motor, and carries a No. 7 handpiece.

The flexible shaft has a diameter of 0.15 in., and the casing of $\frac{3}{8}$ in. Either fabric or metallic casing can be furnished in lengths of 36 and 48 in. The flexible shaft itself consists of layers of fine wire, the direction of winding being reversed in each layer. The motor shaft is hollow at one end to receive the end of the flexible shaft, and a special construction of the bearing housing is provided to carry the casing for the flexible shaft. The tool is especially useful for work on small dies and for undercutting mica on the armatures of small electric motors. Complete equipment for all types of work can be furnished, as abrasive wheels, drills, small mills and burs are all available. The handpiece incorporates a small locking chuck by which the mandrels of the tools can be securely held.

An outfit driven by a $\frac{1}{4}$-hp. motor operating on 110-volt alternating or direct current at a speed of 1,750 r.p.m. is shown in Fig. 2. This Type Y motor is for heavier work than the Type W, and is applicable to a large variety of operations such as grinding, polishing and drilling that are required in a machine shop. The shaft of the motor is machined to receive the flat end of the flexible shaft. A screw collar holds the casing securely on the end of the housing. A connecting cord and plug having a push switch are provided.

The flexible shaft is ordinarily furnished in sizes of 0.250, 0.312 and 0.375 in., the size of the casing being $\frac{1}{2}$, $\frac{5}{8}$ and $\frac{3}{4}$ in., respectively. As with the smaller shaft, helical layers of spring-steel wires tightly laid in strands of three or four wires each form the shaft. The diameters of the wires in the different strands depend on the size of the shaft, and the position in the shaft. The smallest size casing is covered with fabric, consisting of a flat wire spring or helix over which is laid a series of cotton braidings that are treated with varnish, baked and then polished. The two largest casings are metallic, and are more durable although not quite as flexible as the fabric casing.

The No. 3 handpiece has two interchangeable chucks, so that drills and shanks from the smallest made to $\frac{1}{4}$ in. in diameter can be gripped. The chucks are of the three-jaw variety, and provide a rigid grip. The spindle carrying the chuck is hardened and ground and runs in a hardened ground bearing. A thrust washer of anti-friction metal is provided.

The fore part of the sheath or grip practically covers the cap nut on the chuck socket, so as to protect the thrust bearing from dirt and abrasive and permit the operator to grasp the handpiece nearer the working tool. A reservoir for oil is provided in the handpiece. The construction is such that taking down for cleaning can be easily performed. Cutting tools, wheels and similar equipment can be furnished for all types of work.

News Section

Machine Tool Builders Declare Stock Dividends

Important changes in the capitalization of three of the major plants in the machine tool industry of Cincinnati were announced last week by officers of the interested companies.

The companies involved are the R. K. Le Blond Machine Tool Company, the Cincinnati Bickford Tool Company and the Cincinnati Milling Machine Company, all of Oakley.

The Le Blond Company, according to reports, will change the charter of the company from Ohio to Delaware. The company will be dissolved to meet the legal requirements, its Ohio charter surrendered and steps taken to reincorporate under the laws of Delaware.

At the same time questions relative to an increase in capital will be decided, according to E. G. Schultz, treasurer of the company.

The reorganization of the Cincinnati Bickford Tool Company was effected yesterday through the issuance of a charter at Columbus to the Cincinnati Bickford Company, capital $2,000,000.

C. P. Gradolf, secretary of the Bickford company said that the new charter was in effect an authority to increase its capital from $500,000 to $2,000,000 for the purpose of distributing stock valued at $1,025,000.

The newly authorized issues are $1,000,000 preferred 6 per cent and $1,000,000 common. At present a total of only $1,025,000 is to be issued, according to Secretary Gradolf.

Of this, $500,000 will be issued in blocks of 6 per cent preferred at $100 par and the $525,000 common will be issued in $25 shares. The remainder of the authorized capital will be held in the treasury for further expansion.

President A. H. Tuechter said that the $500,000 preferred is to be distributed among the present shareholders.

Yale Begins Lectures on Engineering Profession

Lectures by prominent engineers are being made part of the program of development of the engineering courses in the Sheffield Scientific School of Yale University along broader university cultural lines. These lectures will deal with the engineering profession as a whole—with its history, opportunities and obligations, with its attitude toward public and private needs, its notable achievements, and kindred topics.

Special lecturers are being chosen both for their knowledge of engineering and for their experience in dealing with public problems. The first lecturer was John Hays Hammond. The second will be L. W. Wallace, executive secretary of the Federated American Engineering Societies, and a former member of the faculty of Purdue University. Mr. Wallace, who was vice-chairman of the Hoover Committee on Elimination of Waste in Industry, and who is president of the Eye Sight Conservation Council of America, will speak at Yale on December 12.

Mr. Wallace's subject will be "The Engineer in Industry." Among other things he will discuss the report of the Committee on Work-Periods in Continuous Industry of the Federated American Engineering Societies, which found that the twelve-hour day in industry was economically unnecessary. President Harding has characterized this report as representing his "social viewpoint."

Pennsylvania Road Raises Pay of 30,000

Wage increases aggregating approximately $1,800,000 annually have been granted 30,000 maintenance of way employees of the Pennsylvania Railroad system, John G. Rodgers, vice-president of the Northwestern region of the road, announced in Chicago last week.

The increases ranged from one cent an hour for carpenters, painters and masons' helpers to five cents an hour for assistant bridge and building foremen and will be retroactive to November 1.

The adjustment was reached through a series of conferences between the general managers of the four regions of the road and the Pennsylvania System Fraternity, a company organization.

The Pennsylvania refused to settle with the Federated Shopcrafts when their recent strike was terminated on some roads and instead organized its employees into a company union. The employees then elected representatives to negotiate all differences with the management.

A Triple Convention

F. D. Mitchell, secretary-treasurer of the American Supply and Machinery Manufacturers Association, with offices at 1819 Broadway, New York City, issued last week an advance announcement of a triple convention of the National Supply and Machinery Dealers Association, the Southern Supply and Machinery Dealers Association and the American Supply and Machinery Manufacturers Association.

The convention will be held in Cincinnati, Ohio, May 17, 18 and 19, 1923 with headquarters for all three associations at the Hotel Sinton.

Industrial Engineers Meet in Springfield

At the opening winter meeting of the Western New England chapter of the Society of Industrial Engineers in Springfield, Mass., the discussions related to the topic "The Planning of Work." In a paper on "Sales Forecasts" Walter F. Bachelder, secretary of George W. Prentiss & Co., wire manufacturers, Holyoke, Mass., told of the value of a systematized policy looking to a more even flow of production.

Bradstreet Price Index Shows Advance

Bradstreet's index number of average commodity prices on Dec. 1, for which the first computation was published by Dun's Review last week shows an advance of 3.3 per cent in the general average during October, as compared with an increase of only 1⅗ per cent shown by Dun. As compared with a year ago, the increase is 21.9 per cent.

From the high point of 1920, reached on Feb. 1, it shows a decrease of 33.9 per cent, as against a decrease of 29.5 per cent from the 1920 maximum shown by the Dun percentage. The December average, according to Bradstreet's, stands 58.2 per cent above that of Aug. 1, 1914. In the Dun computation, the December average stood 53⅗ per cent above that date. Food products and textiles led in the advance of Bradstreet's average, as well as Dun's.

Rail Executives Drop Labor Policy

The Association of Railway Executives last week decided to withdraw, so far as possible, from all questions dealing with labor, traffic and public relations, and to restrict the functions of the association to questions of national legislation, governmental action and policies and legal matters with a nationwide application.

The railroad executives also decided to leave the place of the late Thomas De Witt Cuyler, former chairman of the association, unfilled and to abandon the New York office. Headquarters will be maintained in the counsel's office in Washington in the future.

Today's action marks the passing of nation-wide treatment of strikes and strike threats. Whereas the association dealt as a whole with the shopmen's strike last summer and the threatened strike a year ago, in the future each individual road or each regional executive body will act.

Members of the organization said one of the purpose of today's decision was to get the treatment of labor questions back in the hands of the individual roads. It is impossible, they said, to deal with the railroad workers of the entire country on a just or equitable basis and so long as the system of nation-wide treatment continued they declared it would be impossible to get back to economical operation of the carriers.

The affairs of the association will be vested in an executive committee to be elected annually by the association.

Chalmers Motors Sold

The Chalmers Motor Company in Detroit was purchased at a receiver's sale last week by Boyd G. Curtis, local attorney representing the Maxwell Motor Company. The sale price was $1,987,600.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

LAST week I made a hurried trip through the Middle West, stopping at Pittsburgh, Cleveland, Chicago and Minneapolis as well as some other minor points. At each place I talked with several prominent business men and sought to check off the reports of business conditions received in New York which are not always reliable because they cannot reflect the feeling and temper of the distant communities upon whose confidence in the future and contentment with the present our prosperity is largely dependent.

Summarizing my impression it may be said that those who deal with city people are reasonably busy and expect a good trade through the winter, but that the others whose business is chiefly with the agricultural or rural districts are not optimistic. The latter class say that while the farmer has lately been buying a little more freely he is still heavily in debt and that his purchases have been and will be confined to the things that he cannot do without. As attesting the correctness of this view I had my attention called to the number of small banks that have recently failed including one each at Omaha, Nebraska, Sterling, Colorado, Huntley, Montana, and Andale, Kansas, whose suspension was reported on the 4th of December.

These conditions are generally attributed to the disparity between the price of what the farmer has to sell and the things he must buy and this disparity is in turn chiefly ascribed to the high freight rates and the inability of the railroads to handle the tarffic offered.

In Minneapolis it was asserted that the entire potato crop of the Minnesota Valley, said to be worth many millions, was rotting on the farms because cars to carry it could not be had and the proprietor of an important factory in a Wisconsin town told me that he was having all his raw material and output shipped by express because the freight service was so slow. He added that the interest he saved on the capital tied up more than paid the increased cost of transportation.

The railroads realize their predicament. President Markham of the Illinois Central and President Storey of the Santa Fe are both publishing paid advertisements explaining that their hands are tied by over-regulation; but their explanations do not move the traffic and in their blind indignation the people are writing their representatives in Congress demanding that the Government shall "do something" though there is no general agreement as to what this "something" shall be.

Another cause of discontent is the stampede to declare stock dividends that is reported in the papers. As I sat in the smoking car on my way from Cleveland to Springfield, Ohio, I heard two men commenting upon the headlines over an announcement that the Atlantic Refining Company had declared a stock dividend of "900 per cent." One of them appeared to be a country doctor. The other said he was a farmer. Their larguage is hardly printable but they were agreed that Wall Street was a den of thieves who controlled the capital of the country and used their power to rob the defenseless and evade taxation.

These observations are recorded not only because they account for the so-called radicalism in Congress but because they connote a discontent that is, I fear, incompatible with the "good times" whose arrival or approach so many are now loudly heralding.

But insofar as concrete fact can be differentiated from the no less important factor of feeling or sentiment, it is to be admitted that they are encouraging.

Cotton, wool and the fabricated articles into whose manufacture these and other staples enter are in fair demand at prices which are satisfactory though they seem to have stopped advancing.

Money is slightly easier at 4½ per-cent for the very best commercial paper and the Federal Reserve statement seems to indicate a continued abundance of credit despite a reduction of 2.1 per cent in the Federal Reserve ratio which reflects a decrease of $27,000,000 in the gold held due chiefly to the effort made to put "yellow backs" into circulation.

Sterling exchange has advanced to 4.56½ which is the highest price touched since July, 1919, when the British Government pulled the war "peg" out. This ought to facilitate our trade with that large portion of the world which still measures values in pounds, shillings and pence.

There is no speculation in either securities or merchandise, no one is overstocked and away from the few large cities where wealth displays itself, there is little or no extravagance.

There is a job at good wages for everyone who is willing to work and there is but little idleness.

Wealth, which has been aptly described as "canned labor," must therefore be increasing and the problem of the statesman and the economist is to induce its productive employment. That a solution for this problem cannot and will not soon be found is unbelievable but the doctors have not yet agreed upon the remedy that should be applied. Secretary Mellon advises a reduction in the super-taxes so that private capital will not be driven into tax-exempt bonds whose proceeds are often wastefully employed.

It is doubtful whether Mr. Mellon's proposal is politically practicable with Congress and the people in their present temper but there is much to recommend his suggestion for the weakness of the stock market is largely due to the hysterical eagerness of large capitalists to convert their taxable stocks and bonds into tax-exempt securities. In the case of the railway shares the declining tendency has been accentuated by the fear that the Farm Bloc or the Progressive Bloc or some other Bloc will succeed in securing a reduction in railway rates that will be ruinous because a correlative reduction in wages will not be permitted.

Judging from what was said in the West this is unlikely. The people realize that the railroads cannot function if they are bankrupt and in many quarters the idea of subsidizing them as well as the ships seems to be gaining in favor. The theory is that the cost of transportation is, in the last analysis, a tax upon the whole people which would be more equitably distributed if it were assessed as a tax which everyone would pay instead of being collected from the few in the form of freight charges.

For these reasons and because it is generally wise to buy when most people are alarmed and selling, I continue to believe that the stock and bond markets will now repay the bargain hunter. None of us really think the United States is going to economic perdition, failing which many securities are certain to be worth more than current prices when the present depression has passed.

But of commodities it would not be good judgment to generalize so indiscriminately. None of the staples are any longer subnormally cheap. Even sugar and rubber have passed out of this category. And as for manufactured articles they cannot be advanced much more without raising the cost of living to a level that may provoke an outcry and a buyers' strike.

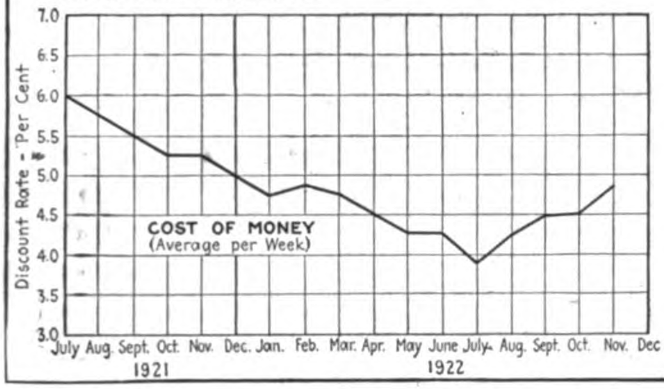
Conservatism and caution on the part of merchants and manufacturers would therefore seem to be advisable, especially as the inflationary power of our redundant money supply seems to have spent itself. This is perhaps explained by the continued disbursement of gold certificates by the banks and the amount of our Federal Reserve currency in circulation in Europe where according to reliable reports it is becoming the preferred medium of exchange in the retail trade of the Continent.

Exports of Steel and Iron Increase

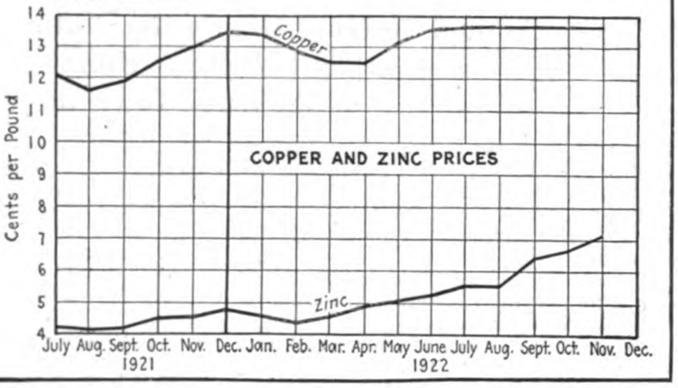
Exports of iron and steel, after declining steadily since June, increased 3,367 tons in October.

According to the official compilation of the Department of Commerce, made public yesterday, the total tonnage shipped abroad during the month was 134,095. This compares with 130,728 tons in September.

Average weekly rates for 60 and 90 day commercial paper based on daily New York quotations furnished by the Journal of Commerce.



Average of New York weekly quotations on electrolytic copper and zinc as reported by Engineering and Mining Journal-Press.



Cost of money as reported from the various points in the Federal Reserve System shows a firmer and higher tendency. City and country banks have been in the market for prime commercial paper and an excellent demand has been in evidence with fairly liberal offerings. The range in rates during November was definitely between 4¾ and 5 per cent as compared with an approximate range of 4½ to 4¾ per cent in the month previous.

Equipment shares fell off again during November, the average price of ten representative issues dropping from $106.50 to $100.30, thus showing a full ten-point decline from the high average mark of September. Profit taking has been in evidence to a large extent with the general public manifesting little interest in the market. Declarations of huge stock dividends on the part of many companies is also mentioned as a factor in causing the depression.

Copper and zinc prices, on the average, show but fractional changes during November. The average price on the New York market for the former was 13.598 cents as against 13.632 cents in the month previous. Zinc averaged 7.104 cents as against 6.840 cents in October. Export business in copper continues fair with France and Italy as the principal buyers. In the domestic market there has been a fair volume of business with producers optimistic as to prospects for 1923. The zinc market shows improvement with good support as a result of European buying, and increased domestic demand.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

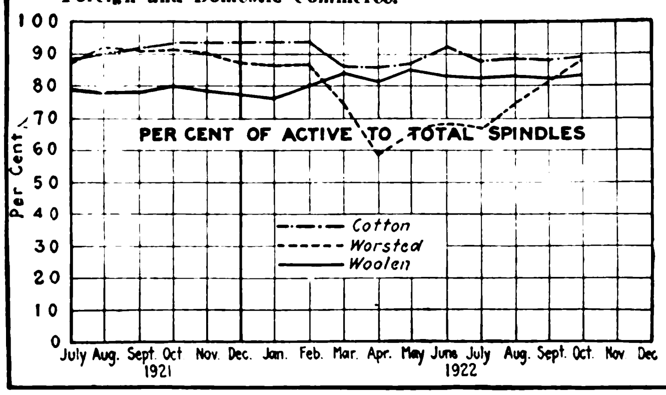
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0295	$0.0295	$0.0273
Cold finished shafting......	per lb........	0.0378	0.0378	0.0373
Brass rods.....	per lb........	0.171	0.1700	0.15
Solder (½ and ½)	per lb........	0.24	0.23	0.20
Cotton waste..	per lb........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal......	0.59	0.575	....
Machine oil....	per gal......	0.36	0.36	....
Belting, leather, medium......	off list......	30–10% @ 50%	40–5% @ 50%	
Machine bolts up to 1 x 30 in.	off list......	55% @ 60%	50% @ 65–10%	50% @ 60–10%

Textile industrial activity in the United States during the month of November compares favorably with the month previous. Cotton spindleage in operation amounted to 85.4 per cent of the total in place as compared with 84.4 per cent in October. In the woolen industry the activity has been nearly the same as in the previous month, November showing 90.8 per cent as against October with 90.6 per cent. Worsted conditions continue to improve, active machinery amounting to 89.1 per cent as against 81.4 per cent in October. The demand for woolens and worsteds continues steady, and cotton yarn prices are strong. Exports of cotton goods continue in good volume.

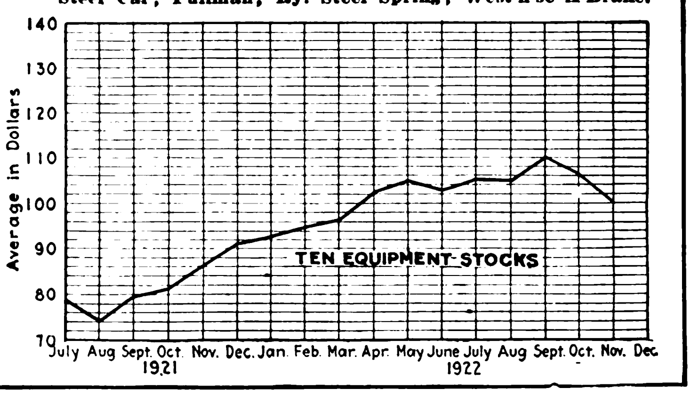
Railroad earnings of American railroads, according to the final report for 189 out of 192 roads of Class 1, showed a net operating income for October of $85,234,000, which represents a return on an annual basis of 4.05 per cent on the tentative property valuation. This compares with a net of $105,425,600 for October, 1921.

Commercial failures in the United States in November, according to reports furnished by Bradstreets, numbered 1758, an increase of 9.8 per cent over the total reported for October and the largest in any month since May. Liabilities totaled 54 millions, 46 per cent above those of October.

Monthly percentage of active cotton, woolen and worsted spindles to the total in place as reported by the Bureau of Foreign and Domestic Commerce.



Monthly average: Am. Brake Shoe; Am. Car and Fdy.; Am. Loco.; Baldwin; Lima Loco.; N. Y. Airbrake; Pressed Steel Car; Pullman; Ry. Steel Spring; West'h'se A'Brake.



Mechanical Engineers Discuss Live Problems

Annual Meeting Draws Big National Gathering—Engineer Seen as Pilot of World's Industry—Eminent Men Discuss Economic Problems of the Day—Keen Interest Shown at All Sessions

THAT America is in need of a new type of industrial leadership was asserted by Dean Dexter S. Kimball of Cornell University in his address as retiring president of the American Society of Mechanical Engineers at its annual convention held at the Engineering Societies Building in New York last week.

"Unless we can in some manner change our industrial system so that we can more nearly attain universal well-being and distribute the fruits of our industry more equitably," said Dean Kimball, "we have no reason for believing that our civilization shall endure, and its bones will full surely strew the shores of time with those of the great civilizations that have preceded us."

The features that characterize our present civilization and distinguish it from those that have gone before it were stated to be: (a) Production in agriculture and that in industry are entirely separated, (b) the problem of transportation is added, (c) the worker is separated from ownership of the tools of industry, and (d) division of labor is carried to a high degree.

The engineer is destined to be a powerful factor in modern industry, according to Dean Kimball, because "modern civilization is largely what the engineer has made it, and the civilization of the future will be largely what he wishes it to be." Dean Kimball expressed his unswerving faith in the ability of the engineer always to feed, clothe and house the human race.

Such men as Secretary Herbert Hoover and Governor Hartness of Vermont he characterized as pioneer adventurers in a field hitherto considered the exclusive territory of the lawyer and the politician. "They are," he said, "undoubtedly the vanguard of a larger invading army." Military rule in government is disappearing and legal rule will be modified by new industrial conditions, continued Dean Kimball, who saw in the engineer a new pilot of the world's industrial machine.

Dean Kimball's address marked the evening session of the opening day, Monday, Dec. 4, the morning having been given over to registration of delegates, conferences and council meetings.

Management Session

The outstanding feature of the Management Session, held Tuesday morning in the Auditorium, was the presentation by title of L. P. Alford's paper, Ten Years' Progress in Management. The paper was presented by title only because of its previous presentation and discussion in many cities during Management Week, Oct. 16-21, 1922.

Among the more important points brought out in the discussion was the feeling that management in the future must come more from the bottom up than from the top down, as in the past, and that greater importance must attach to foremen training. It seemed to be the general sentiment that a better knowledge of economics on the part of major and minor executives was a crying need. In the interests of standardization it was suggested that better definitions of management and its functions should be determined upon in the near future.

An excellent paper on Relieving Industry of Burden was read by Wallace Clark, industrial engineer, of New York. Progress reports were offered by the committees on Standardization of Terminology and Standardization of Graphics by the chairmen, F. E. Town and J. J. Swan.

Machine Shop Session

The Machine Shop Session was presided over by F. O. Hoagland, the first paper being that of Forrest E. Cardullo, Chief Engineer of the G. A. Gray Co., on "A New System of Helical Involute Gearing for Use on Metal Planers." The paper gives six characteristics which are necessary to give satisfactory service, as follows:

"The gears must give smooth and uniform motion without impacts, vibration or chatter. If they do not do so, variation in the driving force, or in the speed of driving, will be transmitted to the table, causing it to vibrate and produce chatter marks on the work.

"When the gears wear, they must preserve their correct tooth form, so that they will continue to give smooth and uniform motion without chatter.

"It is necessary that the gearing have ample strength, so that it will transmit the maximum force which can be applied by the source of power, without reaching the elastic limit of the tooth material.

"The several gears must have such tooth forms and widths of face that they will run for a reasonable length of time without serious wear.

"Should there be wear of the bearings and shafts which would permit the gear centers to separate by a measurable amount, the tooth forms must be such that gears will still give smooth and uniform motion.

"The tooth forms must be such that the teeth can be correctly produced by an efficient and economical machining process."

Mr. Cardullo then pointed out some of the problems and experiences encountered in designing the new gearing, among these being the objection to the herring bone gears on account of the practical difficulty of obtaining two helical gears of opposite hand, but of exactly equal helical angle, pitch, diameter and pressure angle. Variation in any of these quantities, in the two halves of either gear, or in the pinion, results in an unsatisfactory and jumpy action. It was, therefore, decided to use helical gears, and to give the bull gear a right-hand helix, which would tend to draw the table toward the operating side of the machine. This is counteracted by the feeding pressure of the tools in at least 90 per cent of the work done on a planer. Since this feeding pressure amounts, with the usual form of tool, to about one-tenth of the cutting pressure, the helix angle of 5 deg. and 40 min. was fixed upon as best for the bull gear and pinion. The remaining gears of the train have a helical angle of about 12 deg., these being so arranged that the end thrust is distributed between bull pinion, intermediate and pulley shafts. Bronze thrust washers provided with oil by a system of forced lubrication take care of the end thrusts. The frequent reversal of the planer insures the oil being forced between the bearing surfaces and eliminates the lubrication problem.

The Gray tooth has a 14½ deg. pressure angle with a pinion addendum of 3/2 p, and a pinion dedundum of ½ p, where p is the normal diametral pitch. The pitch circle is the same as that of the standard involute gear, but the outside diameter is considerably larger in the case of the Gyra, and the tooth is also considerably wider at the base.

Gear chatter is said to be caused by periodic variation in the amount and direction of the tooth pressure. Such variations, when finally transmitted to the table rack, have two components, one in the direction of motion and the other in a vertical direction. The first of these components is harmless, the second produces vertical movement of the table and work. A low-pressure angle between bull gear and table rack tends to eliminate this vertical vibration.

This paper provoked considerable discussion from representatives of the Whitcomb-Blaisdell Co., the Acme Machine Tool Co., the Pratt & Whitney Co., and the Westinghouse Electric Co. The Whitcomb-Blaisdell Co. has also used helical gears for planer drive, and has offset the thrust by changing the angle of the ways from 45 deg. each side of the center to 40 deg. on the thrust side, and 50 deg. on the other.

New Method on Bevel Gears

Under the heading of "Spherical Gears," Charles H. Logue, of the Brown-Lipe-Chapin Co., presented a somewhat novel method of studying bevel gears, by considering their pitch surfaces as being parts of a sphere. By acquiring this point of view, not only are the elementary features of bevel gear design brought out and applied to spur gears, but also the real connection between the two types is shown. This is considered essential to a complete understanding of either type. The author endeavored to point out the necessity for a difference in the design of the teeth, which has not been previously considered, and to present the entire matter in as simple a way as possible.

"Testing Involute Spur Gears"—by M. Estabrook, of the Niles-Bement-Pond Co., first showed the usual methods of testing gears, and then gave details of the Saurer gear testing machine, which records defects in spacing, pitch, tooth curve and eccentricity. The main difference between this device and those generally used is that this not only shows when a gear is defective, but shows what is wrong with it.

Walter Ferris, of the Oilgear Company, presented a paper which described very completely the hydraulic transmission variable speed device of the Oilgear Company, which has already been illustrated in our columns. The results obtained in practice indicate that this method opens a field in which great improvements in machine tool design may be made.

The last paper of the session was on "Power Required for Cutting Metal"—by Fred A. Parsons, Chief Engineer of the Kempsmith Milling Machine Co. This paper gave the result of an investigation extending over a period of more than ten years. The purpose of this investigation was to determine the fundamental laws governing milling, turning, planing and drilling operations on the various metals and alloys used in machine construction. In addition to a very large number of tests made on milling machines constructed by the Kempsmith Co., those reported by Frederick W. Taylor and Professors Bird and Fairfield in previous volumes of the society's transactions have been carefully analyzed, and the following variables studied:

1. The efficiency of the machine.
2. The rate of metal removed in cubic inches per minute.
3. The average thickness of chip before distortion.
4. The front rate on the cutting blade.
5. The material being cut.
6. Spiral angle or shear on the cutting blade.
7. The condition of the cutting tool as to its being sharp or dull.

The meeting of the machine shop section was well attended, and interest was maintained throughout the session.

Education and Training for the Industries

That division of the Tuesday afternoon session devoted to the report of the Committee on Education and Training for the Industries was well attended and of absorbing interest. It showed that many good minds are constantly engaged in the work of planning ahead for the good of industry along educational lines. W. W. Nichols, chairman, read the report of the committee. Three other reports were given, namely, Extension and Correspondence Schools, James A. Moyer; Industrial Education as Represented in Schools, C. R. Richards, and Schools for Apprentices and Shop Training, R. L. Sackett.

Mr. Moyer's report on Extension and Correspondence Schools stated that nearly every state has a correspondence school system supported by taxation. It outlined briefly the usual type of course. In enumerating the advantages of correspondence and extension courses Mr. Moyer said that the student quickly came to recognize that correspondence study has its own peculiar advantages; that it is available to him at any place and at any time; that each paper he submits gets the individual and undivided attention of an instructor; that bluffing is out of the question—he must prepare himself on every part of the lesson; and finally that he must set his own pace unhurried by more brilliant students and unhampered by sluggards. He stated further a result of correspondence courses and university extension classes is the unexpected spirit of democracy to which they have risen, explaining that social groups which ordinarily acknowledge no common interests have learned to know of each other through the common interest in correspondence lessons; and that those brought together in classes, having profited by the same instruction, have been lead through class discussion to discuss their views with the utmost cordiality and freedom.

The report gave some details of results accomplished in the extension courses of universities in Massachusetts and Wisconsin and concluded with a summary of university extension service in various institutions.

Economic Session

Prof. Wesley C. Mitchell of Columbia University and director of the National Bureau of Economic Research, was the first speaker at a joint meeting of the American Society of Mechanical Engineers and the American Economic Association held on Wednesday evening. He spoke largely on the relation between the three views that may be taken of the purpose of production: Subjectively, to fill needs; industrially to make goods; and economically, to make money. The idea was advanced that probably profit making was of the first concern, as it enabled the further building of our economic system and the promotion of the general welfare of all in the community.

JOHN LYLE HARRINGTON
President, A.S.M.E.

Substitution of "the rule of reason and intelligence" for force in an effort to restore in America "the freedom of the individual, be he employer or employee," was urged by E. M. Herr, president of the Westinghouse Electric and Manufacturing Co., Pittsburgh, Pa., who spoke on the "Human Problem in Industry." In developing his subject, Mr. Herr went back into ancient history and told of some interesting conditions and legislation.

Mr. Herr advocated a change in the immigration laws, saying: "With industry dependent to such a large extent upon foreign-born workers, the recent immigration laws threaten for lack of common labor, the return to and maintenance of normal production. It is to be hoped that these laws will be made reasonably liberal and that restrictions will be based on fitness instead of as at present without regard to the immigrant's character or qualification to become an American citizen."

Discussion of the subjects covered by Prof. Mitchell and Mr. Herr was presented by Dean Kimball; H. R. Seager, president of the American Economic Association; John L. Harrington, president-elect of the A.S.M.E.; Ernest F. Du Brul, manager of the National Machine Tool Builders' Association; and Fred J. Miller, past president of the A.S.M.E.

The remarks of Mr. Du Brul which were particularly well received, dealt with the necessity of "selling" economics to the business man, just as has been done with other sciences. Business men are not aware of the good that economic science can do for our conditions, and they are none too well impressed with the more radical type of economic theories that frequently gain hold on the popular mind. Sound economics properly applied, stated Mr. Du Brul, can certainly build a more stable business structure.

Safety Engineering Session

In discussing the Development of Safety Codes, M. G. Lloyd of the Safety Code Correlating Committee, pointed out the need for Federal rather than state laws and codes, so that the manufacturers of machines would know what was required in the way of protection and not have to make changes according to the state into which the machine was going. He pointed out that the average deaths from accident in this country was 76,000 or as many as were lost by the American army in the world war. Of these 12,500 are industrial accidents. This number is decreasing as safety work progresses.

This was followed by a paper by A. D. Risteen on Safety Engineering in Connection with the Compression of Gases, dealing with the safe handling of oxygen, acetylene carbon dioxide, ammonia, chlorine, argon, nitrogen and air.

G. E. Sanford showed a number of lantern slides of good and bad mountings for abrasive wheels as well as diagrams showing the proper kind of flanges.

Thursday, Dec. 7 was given over to simultaneous sessions of the Power, Safety Engineering, Standardization, Ordnance, Aeronautic and Forest Products Divisions.

Aeronautic Session

While four papers were scheduled for presentation at this session, the one on night flying was not available. Archibald Black, who was in charge of the design of the experimental plane in which the first Liberty engine was installed, gave a very complete paper on the Influence of Design on Cost of Operating Airplanes. This gave a great amount of data from various sources, in an endeavor to clear up much prevalent misunderstanding. Diagrams were given showing curves of operating cost for varying duration and speed of flight, reserve horse power, etc. Air Mail Service costs were used as a basis although operators of commercial lines in both this country and England, consider them much too high. These show that planes designed for commercial use and fully loaded, can be operated at a total cost of from 0.030 to 0.032 cents per pound mile or 6.5 cents per passenger mile, exclusive of the cost of obtaining the business. He shows very clearly that, as in so many other businesses, the cost of selling is more than the cost of production. He sums up his studies as follows: The designed duration of flight should not exceed the minimum necessary to complete scheduled trips safely in a head wind and that, for the types considered, should not in any case, exceed four hours. That the factor of safety should be kept to the minimum consistent with the conditions and should in no case exceed six. That high speeds beyond those accompanying the necessary re-

serve power are undesirable and, for the types considered, should not exceed 105 to 110 m.p.h. at 5,000 ft. That climbing speed should be only sufficient to provide a reasonable margin of safety for emergencies, an initial rate of climb of 400 to 500 ft. per min. from the field being the proposed standard. That reserve horse power be kept down to that necessary for required climbing speed. That flying on one of two engines in a plane is impracticable because of prohibitive cost. That flying on two of three engines is reasonable and practicable. That initial rate of climb instead of reserve horse power or speed range should be the measure of safety. That the moderate sized machine is most efficient at present and for the type considered this is from 500 to 600 sq. ft. in wing area.

Ralph H. Upson showed that for the lighter than air machines the non-stop routes should be longer than for planes, 500 miles or more, that the load should be at least 200 passengers or 50 tons of goods per trip, made up of passengers whose time is worth at least $6,000 per year or goods worth $2 per ton hour. Although the New York-Chicago route is the worst possible from a weather standpoint, Mr. Upson believes that a nightly, 12 hour service can be maintained 100 per cent on time for six months of the year, this would however be cut to 93 per cent for the whole year.

Air Navigation, by the late Prof. R. W. Willson and M. D. Hershey was presented by the latter. This pointed out the problems of navigation in long air flights and in cases where the ground is not clearly visible. This in common with the other papers, evoked considerable discussion. A resolution was passed urging the adoption of Federal laws governing inspection and licensing of both aircraft and pilots.

Power Session

The Power division's session was presided over by J. H. Lawrence at which the following papers were read: Tests of a Type W Stirling Boiler at the Connors Creek Power House of the Detroit Edison Company, by Paul W. Thompson; Feed Heating for High Thermal Efficiency, by Linn Helander; High-Temperature and High-Pressure Steam Lines, by B. N. Broido; The Elasticity of Pipe Bends, by Sabin Crocker and S. S. Sanford; and, The Commercial Economy of High Pressure and High Superheat in the Central Station, by Geo. A. Orrok and W. S. Morrison.

Standardization Session

The Standardization Session under the auspices of the Standardization Committee with the American Engineering Standards Committee co-operating, was held Thursday morning with Col. E. C. Peck of the Cleveland Twist Drill Company in the chair. Two papers were presented. The first one was A Program of Standardization of Paper and Printing Machinery, by Wm. J. Eynon. This was contributed by the committee on printing machinery. It was brought out that standardization of machinery and machine parts must be postponed until standardization of paper sizes, styles and composition has progressed further than it has at the present time. Encouraging progress has been made in a few instances, notably by the American Writing Paper Company, but there is still much to be done.

The second paper was one of the most interesting of the session, from our point of view, and attracted some lively discussion. The title was Size Standardization by Preferred Numbers and the joint authors were C. F. Hirshfeld and C. H. Berry, both of the Detroit Edison Company. We have seldom heard a paper presented in better form at an A.S.M.E. session. Perhaps an oversight on the part of the authors had something to do with this. They forgot to bring their slides and as a result the members present had to follow the remarks of the speaker from illustration to illustration. The authors disclaimed any attempt to urge the use of preferred numbers on any industry but they did prove quite conclusively that the subject is one of sufficient interest to merit the careful attention of engineers and manufacturers all over the world. It was brought out in the paper and in the discussion that the Germans have gone far in this branch of standardization although some of the members present seemed to feel that some of the things done in Germany were of doubtful value.

The Ordnance session, with W. H. Marshall presiding heard the following papers: Machining and Lapping Very Deep Holes, by J. B. Rose; and Methods Used in Manufacture of Gun Recoil Mechanism, by R. A. Vail. A feature of the session was the showing of a series of motion pictures illustrating recent developments of mobile ordnance.

An interesting feature of the week's program was the numerous excursions arranged for the benefit of the visiting delegates. On Tuesday the plant of the Wheeler Condenser and Engineering Co., Carteret, N. J., was visited and an inspection of the new Hell Gate power station was held. The Christie Amphibian Gun Mount or Tank gave an exhibition in the Hudson River and attracted great interest.

The visit of the delegates to the McGraw Hill publishing plant at 36th St. and 10th Ave., and an inspection trip of the U. S. S. Maryland at Brooklyn Navy Yard were the features arranged for Thursday.

Social events arranged for the entertainment of the delegates during the session included a smoker, a dinner dance and various excursions for the benefit of the ladies visiting the meetings. Friday evening was set aside for reunions of the alumni of the various technical colleges and dinners were held by the following: Cornell University, University of Kentucky, Princeton University, Purdue University, Worcester Polytechnic Institute and the Massachusetts Institute of Technology.

Officers elected by the society for 1923 were as follows: President, John Lyle Harrington of Harrington, Howard and Ash.

Vice-presidents for two years: William H. Kenerson, professor of Mechanical Engineering, Brown University; Walter S. Finlay, Jr., vice-president of American Water Works and Electric Co.; Earl F. Scott, president of Earl F. Scott & Co., Inc.

Vice-president for one year: Henry H. Vaughan, consulting engineer.

Managers for three years: A. G. Christie, professor of mehcanical engineering, Johns Hopkins University; James H. Herron, president of James H. Herron Co., and Roy V. Wright, editor of *Railway Mechanical Engineer.*

William H. Wiley, and Calvin Rice, treasurer and secretary of the society respectively, were re-elected for the ensuing year.

Making Cast Iron Pipe

"Making Cast Iron Pipe" is the title of a new industrial motion picture shown at the Power and Mechanical Engineering Exposition and elsewhere in New York City this week. The film was made by the Pathéscope Film Service for the United States Cast Iron Pipe & Foundry Co., of Burlington, N. J. It shows the process of casting pipe in sand molds as well as centrifugally.

The centrifugal process of casting pipe was invented by D. S. De Lavaud, a Brazilian engineer, but has been perfected commercially in the United States by the United States Cast Iron Pipe & Foundry Co., which controls the right to its use in this country.

Casting is done in a machine that consists of a permanent, water-cooled mold, traversed longitudinally and rotated, and a pouring device. The only set up necessary is the insertion of a core to form the inside of the bell and to act as a stop for the molten iron.

Pouring is done from a tilting ladle, controlled hydraulically. The iron is discharged into a water-cooled, cantilevered trough, that reaches to the farther, or bell, end of the mold. As the iron runs in, the mold is traversed longitudinally until the pipe is completed. Speeds of traverse and rotation control the thickness of the pipe wall.

Cooling begins as soon as the first iron touches the mold and by the time the pouring is completed the bell end is cool enough to allow the application of a holding device preparatory to withdrawal of the pipe from the mold. As soon as withdrawn the pipe is carried to the annealing furnace. After annealing it is dipped in hot tar, the last operation in its manufacture.

Comparison with the method of casting in sand molds shows that the De Lavaud method requires less equipment and labor beside reducing the time necessary for making pipe from one or two days to a matter of hours, both including cupola work. The actual casting time is very short indeed, because of the necessity of working while the iron is hot. Heat is conserved because the newly cast pipe is taken directly to the annealing furnace. In the same way the tar bath is used after annealing, without reheating. Practically no core making equipment is necessary. It has been found that the centrifugally cast pipe is of very good quality as concerns grain, freedom from blow holes and impurities. It is said to possess greater strength than sand cast pipe, and to offer no difficulties to machining.

Increases Trade Funds $400,000

Appropriations for the Bureau of Foreign and Domestic Commerce are reported to have been reduced by nearly $200,000 below the estimates of the Budget Bureau by a sub-committee of the House Appropriations Committee.

Notwithstanding this $200,000 cut, however, it is the understanding that the total for this bureau will represent an increase of nearly $400,000 over the amount appropriated for the current year. Officials of the bureau are said to be fairly well satisfied with the result as the increase in appropriation will enable the department to carry out many needed improvements in its service to manufacturers.

Business Conditions in Germany

Standard of Efficiency Below Pre-War Level—Industry Burdened by Excess Employment—Machine Tool Industry at Low Ebb

By OUR BERLIN CORRESPONDENT

THE optimists of the business world, who maintained the theory, that the beginning of a business depression, noticeable since September, was a transitory character only and would soon give way to renewed booming under the spur of the money depreciation, have so far been disappointed. The record low point of the mark exchange has, as far as can be recognized, failed to exercise any stimulating influence on the market, rather the contrary is the case. The decline is becoming more and more marked and finding expression already in a gradual rise of unemployment, as is evident from the labor statistics of the National Labor Ministry.

Low Standard of Efficiency

It is a fact that the standard of efficiency, which had greatly improved at one time and ran up to almost 80 per cent has again sunk considerably below this level. Thyssen, the well-known German industrial leader, has lately, in a memorable letter to the Chancellor of State, estimated the present level at 60 per cent. This, evidently, is from observations in his own extremely well organized works. In others, where conditions differ, it is even less. The Rheinische Stahlwerke for instance, one of Germany's largest steel companies, has, in its annual report just issued, stated the standard of efficiency to be 50 per cent. The output of steel per head in this work was, in the last pre-war year, 112,500 tons and is now only 57,000 tons. The report places emphasis on the fact that even the present standard is only maintained by virtue of the costly new equipment and modern labor-saving machines, which have been put in since that time.

The outcry for an increase of production has been heard for a long time. The struggle to this end has up to date chiefly been fought in words, advices and exhortations. Having failed to produce any effect the clamor is now for more active measures, chief among them being the abolishment of the restriction of working time to 8 hours per day. The campaign to this effect is outlining itself quite clearly. It takes its main argument from the coal situation, where the enormously grown imports, chiefly of British coal, are putting the handicaps of production, produced by the so-called revolutionary achievements of the labor class, into glaring relief. The German coal production has gradually declined during recent months. Against an increase of 35 per cent of the mines' complement of workmen, stands a decline of 20 per cent in production.

The fact is, that most enterprises are overstocked with employees. This is particularly pronounced in the case of public works but also applies to private ones. Nothing short of dire necessity can produce the energy required for the process of elimination. Industrial leaders are of opinion that the time of this process has now come, believing evidently that a period of depression will be most opportune. A fight between them and the Government, which is reluctant for political reasons, is being waged deep under the surface.

From the official reports of the National Labor Ministry and of the Chambers of Commerce, the present situation of the machine building industry is the following: The reverse of business, such as has taken place, is most strongly pronounced in the western part of the country, Rhineland and Westphalia, and in the extreme east, Upper Silesia. The various groups of the machine building industry are as yet effected in a different degree. The lines working for transportation, like locomotives, railway car manufacturing and shipbuilding, appear to be in the front rank. In the locomotive industry, it is the decline of foreign orders, chiefly from overseas countries, which has caused a lack of business.

In the railway car industry the full complement of workmen is only maintained in the expectation of orders on reparations account. Business in shipbuilding has become very quiet. Orders from domestic sources have almost stopped and those from abroad can be obtained only by strong efforts and at a sacrifice in prices. Electrical machinery, which so far has enjoyed a privileged position in machine building independent of general market conditions, is still fully employed, but complaining of a strong decline in new orders. It appears that a number of plans for new electrical power stations and extensions have been pigeon-holed. The only exception in this field seems to be railway signal engineering, which was the last to profit from the boom and evidently has not been seized yet by the receding of the tide.

Tool Industry Stagnant

In the machine tool industry the decline of business, commencing in September, has become more acute. The number of orders received for home demand, as well as from abroad, is diminishing perceptibly. The export of machine tools, which in August has exceeded that of July, shows a drop in September. The actual shipments in August were 10,127 units weighing 3,881 tons as against 9,371 weighing 2,983 tons in July. In value this increase was much higher, i.e., 182 million marks in July to 411 million marks in August. By translating these figures into gold marks, this increase, however, not only collapses, but leaves even a deficit.

The July exports show a price per ton of 61,301 marks or, at the average rate of exchange, of 585 gold marks. In August the respective figures were 106,000 paper marks or 400 gold marks. The increase of exports in August falls chiefly to the share of Belgium and Austria, while shipments to Holland, Spain and some other countries show a decline. The grand total of machinery exports in August was 42,850 tons as against 36,380 in July. The respective value was 4,081 million marks in August compared with 1,761 in July. In spite of the increase of the quantity and the apparent rise of value in paper marks, their value, in gold marks, shows no increase.

Great alarm has been caused in the machine building industry by the doubling of the export tax. A special meeting of the Society of German Machine Building Works, which is now heading all German machine building associations, has been convened to protest against this increase and against the view entertained in public opinion, as well as in official circles, that machine builders are reaping enormous profits out of the exchange situation. Various speakers, amongst them Direktor Becker, of one of Germany's largest machine tool building works, the Kalker Machine Tool Works, maintained that freight and the taxes, levied on exports, leave to the manufacturer a net price hardly as high as domestic prices.

Fictitious Paper Profits

The price of raw materials has already reached the world market level. The only advantage remaining to German machine building in comparison to foreign competitors, it was said, is the low cost of labor, which is, however, largely counteracted by the drop in efficiency. Taking into account the cost of transportation and foreign import duties, there is, so it was said, hardly any margin left for the German manufacturer to make his price attractive to foreign buyers.

The profits paid out in paper marks are in no case more than from 2 to 3 times their pre-war figures in spite of the enormous depreciation of the money. This was said in corroboration of the contention that the financial situation of the machine building industry is by no means as satisfactory as it appears on the surface. A scrutiny of the dividends paid in the machine tool industry, which is one of the most fortunate lines, provides, indeed, a striking illustration of this fact. From the annual reports of a number of works just published, the figures in the accompanying table are of particular interest:

It is seen from these figures that the capital stock has increased, but not nearly commensurate with the depreciation of the money. This, in itself, is a healthy sign, as the increase has in most cases been put into the shape of tangible assets. The profits paid out

TABLE SHOWING CAPITAL STOCK AND COMPARATIVE PROFITS OF PRINCIPAL GERMAN TOOL BUILDERS

	Capital million marks 1914	Capital million marks 1922	Profits Paper Marks	1921/22 Gold Marks	Profits 1914 Marks	Sinking Funds Marks
Kalker Maschinenfabrik Breuer-Schumacher	3,6	7,2	2,430,000	2,000	500,000	7,000,000
Werkzeugmaschinenfabrik Gildemeister	1	4	1,460,000	1,460	60,000	600,000
Deutsche Niles Werke	4	10	4,690,000	4,690	386,000	1,800,000
Sächs. Werkzeugmasch. Bernb. Escher	1,5	5	3,600,000	3,600	150,000	530,000

appear, indeed, huge, but expressed in gold marks they drop down to the level of a mere pittance. Compared with pre-war profits, they are almost nil. This explains better than arguments the cramped financial situation even of works highly prosperous on the surface. The whole capital basis of the works seems absurdly inadequate for the huge and ever increasing sums required in the shape of working capital.

In July all of the German corporations received fresh capital only to the extent of 2,706 million marks, in August of 3,751 and in September of 3,715. In gold money this fresh capital amounted in July to 22 million marks and in September only to 10 million marks. The respective figures for September, 1920, were 43 million gold marks and 1921, 30 millions. The actual value of new investments in industry has, therefore, decreased considerably. In machine building, 84 corporations increased their capital by 833 million marks and 72 new corporations have been formed with a capital of 282 million marks. Machine building by far heads the list in this respect among all other lines of industry.

In view of the business depression, which is apparently continuing the attention given to reparations is strongly increasing. Little is heard as yet of actual results achieved by the Stinnes agreement, which, as will be remembered, is the largest working arrangement made so far for reparations in kind, but greatest interest is focussed on the problem as to how it will work out in practice. Numerous manufacturers are trying to establish connection with the Stinnes combine or similar enterprises, of which an additional number are in the state of preparation.

To the same impulse must be ascribed the renewed attention the Russian market is receiving in Germany. An agreement recently arrived at between the firm of Otto Wolff (which is probably the greatest new company organized since the war and controlling the sales department of a number of iron and steel works of the first rank and also several machine tool works) on the one hand and the Russian Government on the other, has added fresh zest to this movement. This agreement is the first on a large scale for the iron, steel and machinery industry and the largest yet concluded. A similar agreement is nearing completion between the Russian State and the firm of Krupp, only awaiting the solution of the problem of financing. In this connection it may be mentioned that the Society of German Engineers is now publishing in conjunction with the Soviet Government a Russian edition of their journal, which is going to be distributed broadcast in Russia through official channels. This enterprise is strongly supported by German industry, which is more than ever alert to the opportunities which the Russian market offers in the future.

Leather Belt Exports Increase in October

According to figures compiled by the Bureau of Foreign and Domestic Commerce, the United States exported 91.1 per cent more pounds of leather belting in October last than in October, 1921, and 3.8 per cent more than in September, 1922.

Simonds Stimulates Study of Economics

Actuated by the desire to advance the study, and more general appreciation of economics, Alvan T. Simonds, President of the Simonds Saw Co., Fitchburg, Mass., and Chicago, Ill., proposes an essay contest open to pupils of high schools and normal schools in the United States and Canada. Mr. Simonds offers two prizes of $1,000 and $500 for the best essays written by students on the subject: "The Lack of Economic Intelligence and Some of the Injuries it has Caused Individual and General Welfare in the United States since 1860."

Mr. Simonds hopes this contest will interest many in the study of economics, who might otherwise pass it by. He also expects it will aid in creating a public sentiment that will result in the practical study of the subject in secondary schools as part of the training of every teacher. By way of suggestion, the donor of the prizes points to the fact that unemployment, hard times, and business failures are economic disorders, which like the diseases of the human body can be avoided by greater economic intelligence. The essays which Mr. Simonds anticipates should deal with facts of this kind as well as explain concrete examples of injury to individual or general welfare, due to lack of economics intelligence. The readiness of many to accept economic fallacies and to act upon them is another phase of the subject writers may dwell upon.

As a foundation from which the essays may be constructed Mr. Simonds suggests that facts and examples which bear on the subject should come from the history of the United States since 1860 with special emphasis upon the present.

Rules governing the contest have been prepared, and persons interested may obtain copies of them by addressing the Simonds Economic Prize Contest, 470 Main Street, Fitchburg, Mass.

New Enterprises Total $808,719,600

Returns specially compiled by the *Journal of Commerce* indicate that seventy-six new companies were organized under the laws of the principal states during November with an authorized capital of $100,000 or more, involving the sum of $808,719,600. This is the best monthly showing in some time. In November a year ago 720 companies were incorporated with a combined authorized capital of $367,956,100. The October returns of this year showed that 756 companies took out charters, representing a total of $651,577,390.

Since Jan. 1 there were 8,685 new concerns chartered with a combined capital of $7,586,252,390. During the first eleven months of 1921 8,744 companies filed articles of incorporation, representing a grand total of $7,340,539,100.

As usual Delaware easily makes the best showing in the returns, followed by Pennsylvania, New York, New Jersey and Massachusetts.

The increase noted in the figures illustrates probably better than anything else that optimism prevails in banking and industrial circles regarding the outlook for general business.

November Brought More Failures

There were 1,758 failures reported to Bradstreet's for the month of November, an increase of 9.8 per cent over the total for October and the largest number reported in any month since May. Compared with November a year ago failures were 10.7 per cent fewer in number, but there was 64 per cent more than in November, 1920, and over four times as many as in November, 1919.

As regards liabilities, it might be noted that the November total this year, $54,080,825, is 46 per cent in excess of those for October, and the largest for any month since April. The total is, however, 25.7 per cent below that of November a year ago, though 21 per cent above the total for November, 1920. As compared with November, 1919, liabilities for the month just ended are more than six times as great.

Business Items

The Ramsdell Tool and Manufacturing Co., of Worcester, Mass., has recently been incorporated under the laws of Massachusetts, to engage in the manufacture of tools, etc. Their capital stock is $25,000, and the officers are: President and treasurer, Frederick M. Ramsdell, 41 Irving St., Worcester; and secretary, William H. Ramsdell.

The New Haven Malleable Iron Co., New Haven, Conn., has recently increased their capital stock from $50,000 to $150,000.

The Locomobile Co. of America at Bridgeport, Conn., by order of Referee Keogh, has been formally transferred to the trustees of the new Locomobile Co. of America, a New York corporation, controlled by W. C. Durant, president of Durant Motor Co..

The Spotz Manufacturing Co., Inc., of Stamford, Conn., recently incorporated to engage in the manufacture of machinery, etc. (as per item published in a recent issue of the *American Machinist*), organized the past week by the election of the following officers: Harry M. Rice, president; C. A. Spotz, vice-president; Carleton Pratt, treasurer; and A. H. Emory, Jr., secretary.

The Buell Brothers Co., Clinton, Conn., has recently been incorporated under the laws of Connecticut, to engage in the general manufacturing business, making metal novelties, specialties, etc. The capital stock of the concern is $25,000, and the firm will commence business with $25,000. The incorporators are William H. and G. V. Buell, both of Lowell, Mass.; Edgar and S. M. W. Buell, both of Clinton, Conn.

The Brightman Manufacturing Co., located on Marion Rd., Columbus, Ohio, has been reorganized following the purchase of the stock from L. H. Brightman and Mary C. Brightman, by a syndicate headed by William C. Waggoner of Chicago. In the reorganization William C. Waggoner was elected president; J. P. Dodds, who has been general manager, was named vice president and general manager; R. C. Johnson, secretary, and Paul A. DeLong, treasurer. These officers with Thomas

Ferry, of the Ferry Cap and Screw Co., of Cleveland, constitute the board of directors. The concern will manufacture shafting, shafting equipment and steel nuts.

Briggs & Turivas, Inc., Westminster Bldg., Chicago, Ill., has purchased the iron and steel plant of Frederick Cowin and Co., Inc., Joliet, Ill., formerly the Joliet Rolling Mills. The plant is a complete one, consisting of a combination 8-in. and 12-in. finishing mill, 12-in. and 16-in. finishing mill and a 22-in. muck mill. It has a capacity of 5,000 tons monthly of finished iron and steel and five railroads serve the property. Whether the plant will be sold by Briggs & Turivas, Inc., as a going proposition or dismantled by them is not yet known.

The Monitor Controller Co., of Baltimore, manufacturer of the "Just Press a Button" system of automatic control for all motor-driven apparatus have recently established in the south a branch office at 1100 Elm St., Birmingham, Ala. William H. Neville will be in charge.

The Bemis Car Truck Co., 369 Birnie Ave., Springfield, Mass., is about to build an addition to its plant, to cost $15,000. It will be a one-story structure, 55 feet wide by 141 feet in depth.

The Bead Chain Manufacturing Co. of Bridgeport, Conn., manufacturer of the bead chain for electric light sockets, during the past week increased its capital stock from $50,000 to $300,000, same to be used mostly to increase production.

The Westfield (Mass.) Manufacturing Co. has changed its name to the Westwire Co. Production of screw machine products, punch press work and radio goods will continue to be the concern's principal lines.

The Coburn Machine Co., has been incorporated at San Diego, Cal., to deal in automobiles and machinery, and to carry on a machine shop with a capitalization of $50,000, of which $300 is paid up. The incorporators are W. E. Coburn, C. W. Coburn and L. B. Henderson.

The Ross Cutter and Machine Works, Inc., Boston, Mass, is the name of a new company recently incorporated by J. A. Ross and J. E. Bellows, formerly associated with the S. A. Woods Machine Co. The new concern will manufacture woodworking cutters and knives.

The plants of the American and British Manufacturing Co., at Bridgeport, Cann., and at Providence, R. I., have been ordered sold by Judge John C. Knox of the United States District Court of Southern New York district. Bids for the plants will be opened Dec 22 by Receiver George C. Van Tuyl, Jr., at the offices of Messrs. Flaherty, Turner & Stevens, 2 Rector St., New York City. Both plants are extensive, the one at Bridgeport alone consisting of about seven acres of ground, and about sixteen major factory structures, with spur tracks and dockage facilities. A certified check for 10 per cent is to accompany all bids.

The V. & O. Press Co., manufacturer of presses, dies and sheet metal working machinery, and for many years located in Glendale, Brooklyn, N. Y., has started work on a new factory at Hudson, N. Y., where the business will be moved about May 1, 1923. The new building will give improved and increased facilities for the manufacture of the company's high grade products, and will also enable the company to broaden the scope of its operations.

The Delta Manufacturing Co., manufacturer of needles for talking machines, has removed its plant from Lowell to Westfield, Mass., and installed its machinery in the Westfield Power Co. building.

The Ohio Valley Machine Shop, Moundsville, W. Va., has under construction a large addition to its works on Thompson Ave., in that city.

The Watkins Manufacturing Co., Wichita, Kan., through E. A. Watkins, president, announces that it will add a new addition to its plant in the near future. The firm will spend approximately $12,000 on a new machine shop addition and it is proposed also to house a part of the Kansas planing mill in this new building.

The Baldwin Locomotive Works has booked new business amounting to $58,919,345 during 11 months of this year, compared with $26,924,126 for the same period in 1921.

The Studebaker Corp. last week ordered a stock dividend of 25 per cent paid to common stockholders. Directors at a special meeting took the action necessary for the payment of the stock disbursement. The distribution will be made on Dec. 29 to holders of record as of Dec. 16. No action by stockholders is necessary, as the corporation has authorized common capital of $75,000,000 of which only $60,000,000 is outstanding.

Personals

C. G. TAYLOR has been appointed director of purchases of the Westinghouse Electric and Manufacturing Co., according to an announcement by officials of the company. He will have general supervision of the purchasing activities of all plants, comprising the electrical group, including the East Pittsburgh; East Springfield, Mass.; Newark, N. J.; Mansfield, O.; Cleveland, O.; Trafford, Pa.; South Bend, Ind.; Homewood, Pittsburgh, and Derry, Pa., plants.

WALTER B. LASHAR, president of the American Chain Co., Bridgeport, Conn., and well known industrially throughout the United States, is recuperating at the Bridgeport Hospital, after an operation for appendicitis.

William H. Raye, president of the Laconia (N. H.) Car Co., manufacturer of trolley cars, etc., has been elected president of the reorganized Walter M. Lowney Co., of Boston, maker of the famous "Lowney" chocolates, candies, et cetera.

L. M. WAITE has been made general manager of the Garvin Machine Co., Spring & Varick St., New York City.

J. F. MITCHELL, for the past two years in charge of the tool-making department of the Weston Electrical Instrument Co., Newark, N. J., has severed his connection with the company.

G. A. SAWIN, assistant to the manager of the supply department of the Westinghouse Electric and Manufacturing Co., has been elected chairman of the committee on instruments and measurements of the American Institute of Electrical Engineers. He has been a member of the Committee since 1920.

GEORGE J. KELLER, who has been identified with the Hannifin Manufacturing Co., Chicago, manufacturer of air-operated chucking equipment and adjustable boring and reaming bars, has been appointed district representative of the company for northern Ohio with headquarters at 1411 Savannah Ave., Cleveland, Ohio.

GEORGE L. ERWIN, who has been for the past ten years with the St. Louis office of Manning, Maxwell & Moore, is now with the sales department of the Chicago office of Kerney & Trecker. He succeeds H. H. Shierk, who is now with the Chicago sales department of the Miehle Printing Press Co.

Obituary

JAMES J. MCCARTHY who has been prominently indentified in the Railway Supply business for many years died on Nov. 25, at his late residence, No. 4800 Kimbark Avenue, Chicago, Ill., at the age of 80. Mr. McCarthy was one of the original organizers of the Independent Pneumatic Tool Co., and served as a director up to the time of his death. He also organized the Chicago-Cleveland Car Roofing Co., and up to the time of his death had taken an active part in its business.

Forthcoming Meetings

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923. Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

Universal Patent Exposition, First Annual Convention and exhibit of patents and inventions, Grand Central Palace, New York City, February 17 to 22, 1923. A. B. Cole, 110 West 40th St., New York City, is chairman.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies' Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society for Testing Materials, Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

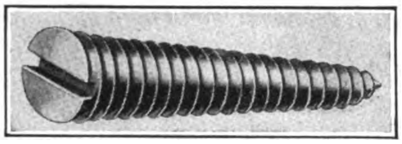
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Kritiscope, for Determining Critical Points in Steel, Nilson
Herman H. Sticht & Co., 15 Park Row, New York, N. Y.
"American Machinist," October 19, 1922

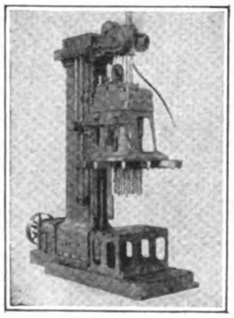
The device is for use in determining the critical points when heat-treating steel. The points or arrests that occur while the part is being heated can be detected magnetically. The tool is touched to the steel and drawn away slightly. If the bar or indicator remains in contact with the work, the latter is still magnetic and requires further heating. The indicator is magnetized by induction from a permanent magnet which, located within the body of the device, is protected from over-heating by the walls. The Kritiscope is packed in a wooden case with extension rods and a shield. It does not require calibration and is not affected by vibration or rough handling.

Wedge, Take-Up, Hammer Handle
Fayette R. Plumb, Inc., Philadelphia, Pa.
"American Machinist," October 19, 1922



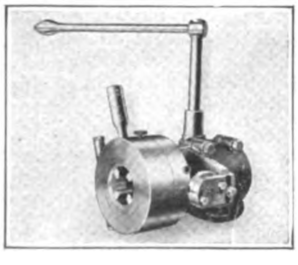
The device provides for retightening the handle in the head of a hammer or hatchet, and consists of a tapered screw of uniform pitch. A slot in the butt end of the screw is for the screwdriver. To fit the screw to a tool, a hole is drilled in the end of the handle somewhat deeper than the length of the screw. It is then reamed to receive the screw, which is driven in until the butt end is flush with the handle. If the head becomes loose in the handle, a slight turn of the screw again spreads the wood uniformly so that it grips in its socket. The screw thread prevents the wedge from flying out under shock.

Drilling Machine, High-Speed, Multiple-Spindle, No. 2A
Baush Machine Tool Co., Springfield, Mass.
"American Machinist," October 26, 1922



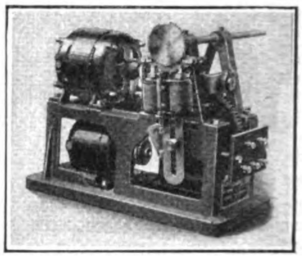
In this machine, the feed pressure is applied directly over the center of the drilling area when a gang of drills is being used in one head. Heads of various sizes, both round and rectangular in shape, can be supplied. Four different methods of drive can be furnished, a three-speed cone pulley, a three-speed change-gear box, motor or belt-driven, or a direct-connected variable-speed motor. Roller bearings are used for shafts and ball thrust bearings wherever required. The machine can be built for tapping in addition to drilling. Capacity in cast iron, twelve 1-in. drills, or the equivalent. Feed, from 0.0018 to 0.023 in. per spindle revolution. Floor space, 3 ft. x 8 ft. 10 in. Height, 12 ft. 3 inches.

Die, Threading, Taper, "Hartness"
Jones & Lamson Machine Co., Die Division, Springfield, Vt.
"American Machinist," October 26, 1922



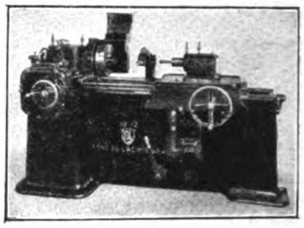
The self-opening die has been redesigned for cutting threads of any taper from zero up to a 2 in. taper per foot. Set for the maximum taper, the die will cut threads $1\frac{3}{4}$ in. long and proportionately longer as the angle approaches the minimum. It is adapted to the cutting of staybolt threads and may be used in tandem with another die in the rear for cutting the parallel-sided portion of the thread. The short handle on the die sleeve is pushed forward until the former pin is brought into the slot in the adjustable former, and the die withdrawn to its extreme position by the pinion lever at the top. Capacity: No. 3 size, threads $1\frac{1}{4}$ in. in diameter at the large end; No. 6, threads up to 2 in. in diameter.

Temperature Regulator, Automatic, Gas Furnace
Chas. Engelhard, Inc., 30 Church St., New York, N. Y.
"American Machinist," October 19, 1922



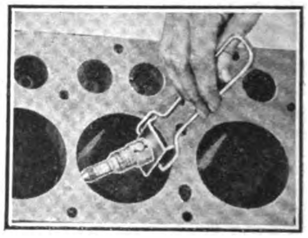
A generator has been added to the former model to provide the low-voltage current formerly supplied from an outside source. The generator is run by a motor operating on current from a lighting circuit. The position and arrangement of the solenoids have also been changed and the terminal board has been added at the end of the frame. The device is ordinarily connected by means of chain to the valve on the gas pipe feeding the furnace, and is connected electrically to a pyrometer. It has three main parts, the motive power, the escapement mechanism and the timer, the motive power consisting of a $\frac{1}{12}$-hp. a.c. or d.c. motor, an 80 to 1 worm-gear reduction, and a 25-watt, 6-volt, d.c. generator to furnish the power for the solenoids.

Grinding Machine, Internal, Automatic, No. 12
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
"American Machinist," October 26, 1922



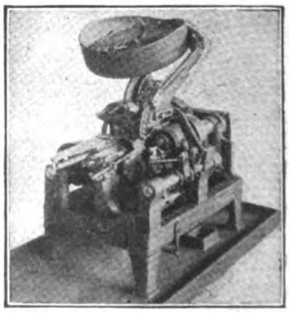
In this machine, an automatic gaging mechanism is incorporated and correlated with the driving and feeding mechanisms. After the operator chucks the piece and starts the feed, the machine will grind to the finished size, automatically trip the carriage feed, and return the carriage to the rest position. The machine is motor driven and equipped with push-button control. The work head is mounted on a circular bearing fitted to a cross-slide. The wheel carriage is reciprocated hydraulically and the driving motor is mounted directly beneath the spindle. The carriage has a maximum travel of 20 in. and six traversing speeds. Capacity, holes $\frac{3}{8}$ to 10 in. in diameter; 9 in. in depth. Swing over the ways, 13 in. Floor space, 7 ft. by 4 ft. 2 in. Weight, 4,400 pounds.

Gage, Micrometer, Inside, Self-Aligning and Centering
L. O. Beard Tool Co., Lancaster, Pa.
"American Machinist," October 26, 1922



The micrometer gage is for measuring the diameters of automotive cylinders, the measuring member being held at right angles to the cylinder walls. The gage consists chiefly of the aligning base, the handle and the micrometer proper. It is furnished in three sizes with ranges of $2\frac{1}{2}$ to 3 in., 3 to $3\frac{3}{4}$ in., and $3\frac{3}{4}$ in. to $4\frac{1}{2}$ in. One turn of the screw advances it 0.050 in. The barrel is graduated to 0.001 in. and figures indicating steps of 0.005 in. are placed on both the spindle and the barrel, those on the former member serving as a check for the reading. The micrometer is locked by means of the setscrew to preserve the reading, and the base slid forward on the barrel so that the tool can be tilted and removed from the cylinder.

Bolt and Capscrew Shaving Machine
Asa S. Cook Co., Hartford, Conn.
"American Machinist," October 26, 1922



The machine, a re-design of the former model, is driven by a single belt from the lineshaft connected to a countershaft under the pan. Separate carriers hold the tools, which face the shoulder under the head and form the top of the head. A gripping device catches each screw as it falls from the feed race. The hopper is stationary and has an annular groove close to the side walls. The ring at the bottom of the groove is revolved with the agitator so that the outer circle of bolts moves continuously toward the high side, where the bolts are discharged into the feed race and supported by the shoulder under the head. The speed may be varied by the driving gears to keep the feed race full of work at all times.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Ala., Birmingham—Inter City Bus Line, (garage and machine shop)—lathe, drill press, emery wheel and stand, belting, electric drill, arbor press, shaft, 2 ton chain falls, hangers and pulleys.

Conn., Waterbury—F. L. Reid, R. F. D. Route 5, (tool work)—one 14 in. Hendey lathe and other small tool room equipment.

Ky., Louisville—Louisville Garage Co.—equipment for proposed $100,000 garage and service station on 5th St.

La., New Orleans—Auto Hospital, 620 Julia St., A. Bray, proprietor—one electric drill for heavy work, and one 12 in. lathe.

Md., Baltimore—Baltimore & Ohio R.R. Co., Baltimore and Charles Sts., W. S. Galloway, Purch. Agt.—angle straightening machine.

Mich., Ann Arbor—American Auto Sales Co., 310 East Washington St.—milling machine, drill and straightening presses for automobile repairing.

Mich., Detroit—Inter City Bus Line, 207 South Woodward Ave.—drill press, 12 x 14 in. lathe, emery wheel and stand and arbor press (used).

Mo., Kansas City—H. R. Bremer, 413 North Drury Ave., (machine shop)—lathe, motor, chucks and small machinist hand tools.

N. Y., Buffalo—Eagles & Kiener, 3074 Main St. (garage)—tools for repair shop.

N. Y., Buffalo—A. B. Goehler, 288 Genesee St.—equipment for machine shop.

N. Y., Buffalo—E. Hank & W. C. Radel, Genesee and Johnson Sts.—equipment for service station, including 1,000 gal. gasoline tank and pump.

N. Y., Buffalo—E. E. Harris & Co., 22 Maurice St.—equipment, including two 1,000 gal. gas tanks and pumps for service station on Tonawanda and Ontario Sts.

N. Y., Buffalo—J. Kahabka, 1261 Fillmore Ave.—equipment for automobile repair shop.

N. Y., Buffalo—Kensington-Davis Corp., 144 Kensington Ave., R. E. Lynd, Purch. Agt.—equipment for metal foundry and machine shop.

N. Y., Buffalo—Pennzoil Co., Inc., 158 Pearl St.—equipment, including 1,000 gal. gas tank and pump for service station at 2082 Niagara St.

N. Y., Buffalo—Valyear Electric Service Co., 2467 Niagara St.—equipment, including 550 gal. gas tank and pump for service station at 145 Ontario St.

N. Y., Jamestown—Standard Oil Co., of New York, 258 Crescent St.—tools and mechanical equipment for $8,000 gasoline and service station on South Main St.

N. Y., New York—H. Kleinert, 920 Brook Ave., (machine shop)—drill press and small screw engine.

N. Y., Rochester—North East Electric Co., 348 Whitney St., (electric starting systems)—one Wieland standard 6 in. pipe threader and cutter; one No. 66 Jarecki pipe machine (used).

N. Y., Rochester—M. Wagner, 186 Franklin St.—tools and equipment for garage and automobile service station.

O., Columbus — Anchor Concrete Mchy. Co., 530 Dublin Ave., E. F. Olsen, Adrian, Mich., Purch. Agt.—planer and 1 or 2 lathes for factory at Adrian, Mich.

O., Columbus—Capital Lift & Mfg. Co., 302 Comstock Bldg., F. M. Taylor, Purch. Agt.—36 in. lathe and one drill press for proposed machine shop.

O., Columbus—Scott & Leiby, rear 135 North Front St., R. S. Leiby, Purch. Agt.—metal working machinery, including cutting off machine and slotting machine.

Okla., Henryetta — Colonial Supply Co., (manufacturer of oil well supplies, etc.)—machine shop equipment for works at Weleetka.

Pa., Carlisle—Miller Bros.—machine shop and automobile service shop equipment to replace that which was destroyed by fire.

Pa., Pittsburgh—H. D. Shawkey Motor Co., 5526 Penn Ave.—machinery and tools for proposed repair department on Penn and Pacific Aves.

Pa., Pittsburgh—National Tube Co., Frick Bldg., S. M. Lynch, Purch. Agt. — large hydraulic press.

Wis., Milwaukee—Bahde Mfg. Co., 2621 Vine St., (manufacturer of patented mechanical articles), C. A. H. Bahde, Purch. Agt. —24 in. shaper.

Wis., Milwaukee—E. Scheunemann, 1445 26th St.—sheet metal working machinery, including brake, bender, etc.

Wis., Sheboygan—F. Heuer, 1608 South 13th St.—automobile repair machinery for new garage and repair shop.

Wis., Watertown—Breuer-Stone, Inc., c/o W. C. Stone, Bank or Watertown Bldg.—machine tools and machinery for the manufacture of specially designed machinery.

Wis., Waukesha—Spring City Auto Co., 220 West Main St.—repair machinery and motors for proposed garage.

Wis., West Allis — G. Richards, 7125 Greenfield Ave.—one lathe for automobile repair work.

Machinery Wanted

Ark., Texarkana — Williams-Hubbard Peanut Co., A. Williams, Purch. Agt. — power paper cutter.

Calif., Los Angeles — Webber McCrea Book Binder Co., 202 East 4th St., A. Webber, Purch. Agt.—ruling machine feeders.

Calif., San Fernando—R. H. Glenn, (job printer)—newspaper press.

Conn., Waterbury—Case Metal Wks.—shear for cutting ⅛ in. brass.

D. C., Wash.—J. A. Wetmore, Acting Supervising Archt., Treasury Dept.—receiving bids until Dec. 28, laundry machinery for the U. S. Veterans Hospital, Bronx, N. Y.

Ga., Union Point — Union Mfg. Co., (manufacturer of hosiery, paper boxes, etc.) —one Payne bobbin winder and one Sargents yarn conditioning machine.

Ky., Salem—G. D. Hearne—machinery and equipment for the manufacture of zinc and byproducts.

Ill., Chicago—G. E. Corbett Boiler & Tank Co., 1332 Cortland St.—three 1 ton electric hoists.

Ill., Chicago—Empire State Ice Co., 76 West Monroe St.—$225,000 worth of ice and refrigeration machinery.

Ill., Chicago — Guarantee Sign Service Corp., 430 South California Ave., W. Dresden, Purch. Agt.—2 power job printing presses, Stone power paper cutter and other printing equipment.

Ill., Chicago — Landfield & Bloom, 128 North Wells St., (printer), V. Notary, Purch. Agt.—Gordon press and paper cutter with power attachment.

Ind., Evansville — Globe, Bosse, World Furniture Co., 600 West Maryland St.—woodworking machinery and equipment for addition to plant.

Ind., Indianapolis—J. Briggs, 3323 Park Ave.—machinery and equipment for the manufacture of stucco and concrete products.

Ind., New Albany—Period Cabinet Mfg. Co.—machinery and equipment for addition to furniture factory.

Kan., Wichita—Alpine Ice Co., 13th and Rock Island Sts., C. M. Beachy, Purch. Agt.—90 ton ice machine, belting, pulleys, hangers, bearings and motor.

Kan., Wichita—Jacob Dodd Packing Co., 21st St. and Lawrence Ave.—refrigeration equipment for proposed plant.

Kan., Wichita—B. Roberts, 1423 North Lawrence Ave. (job printers)—linotype machine (used preferred).

Ky., Whick—G. Noble—additional coal mining machinery and equipment.

La., Arcadia—Bienville Democrat—12 x 18 in. Chandler & Price job press, remelting furnace, linotype and matrix box.

La., Coushatta—Gulf State Land & Lumber Co.—machinery and equipment, electrically driven, for lumber mill and plant.

Mass., Boston—Armstrong Knitting Mills, 99 Chauncy St.—machinery for addition to knitting mill at Roxbury.

Mass., Bridgewater—L. Q. White Shoe Co.—several glass folding machines for present factory (used); also machinery for proposed factory.

Mass., Brighton (Boston P. O.)—M. A. Lang, 238 Western Ave.—machinery and equipment for new bakery at 37 Everett St.

Mass., Brighton (Boston P. O.)—New England Spun Silk Corp., 342 Western Ave., (manufacturer of silk specialties)—additional machinery (new or used).

Mass., Cambridge (Boston P. O.)—Palmer Electric & Mfg. Co., 175 5th St.—one power shear for cutting 14 gauge plate.

Mass., Clinton—Roubaix Mills, Inc., 79½ Main St., (woolen mills)—additional machinery for dye house.

Mass., Dorchester (Boston P. O.)—James Russell Boiler Wks., 9 Dewar St., (boiler specialties)—machinery and small tools for new addition to shop.

Mass., Everett—Bd. Educ., c/o R. Hobbs, E. H. Newton, Chn. Purch. Comn.—woodworking and metal working machinery and tools for manual training department of new high school.

Mass., Fitchburg—St. Francis Mills, (cotton mills), R. B. Lowe, Pres., c/o Parkhill Mfg. Co.—additional machinery for mill.

Mich., Lansing—Federal Drop Forge Co., South Washington St., M. R. Carrier, Genl. Mgr.—drop forge hammers and die sinking equipment.

Minn., Lake Crystal — Graphic, (newspaper)—24 x 30½ in. chassis for press.

Mo., St. Louis—J. Heidemann, 1454 St. Louis Ave.—oil pumps and storage tanks for filling station on Blair St. and St. Louis Ave.

Mo., St. Louis—L. S. Williams, 3232 Pine St. (undertaker)—oil pumps and storage tanks for filling station at 4017-19 Finney Ave.

Mo., Springfield—B. L. Munell, R. O. Box 249 (contractor)—rock crusher.

Neb., Lincoln — Mayer Bros. Co., 1007 19th St., Fairbanks platform scales, to weigh up to 1,000 lb.

N. J., Essex Fells—Evans Lead Co., S. M. Evans, Pres.—machinery and equipment for plant, for the manufacture of lead, red lead, oxide, etc., at Charlestown, W. Va.

N. Mex., Lakewood—G. E. Wedel—knitting machinery.

N. Y., Batavia — Batavia Rubber Co., Robertson St., W. Freeman, owner, (manufacturer of tires and tubes)—machinery and equipment to increase output of plant.

N. Y., Binghamton—Binghamton Caster & Specialty Co., Inc., c/o H. C. Miller, 11 Floral Ave.—machinery and equipment for the manufacture of casters.

N. Y., Buffalo—T. Chaltas, 187 North Pearl St.—candy making equipment.

N. Y., Buffalo—Ebbco Beverage Co., Inc., 449 Woodlawn Ave., C. J. Harnick, Purch. Agt.—equipment for the manufacture of beverages.

N. Y., Buffalo—Hoeffler Ice Cream Co., Inc., 296 Connecticut St.—machinery and equipment for the manufacture of ice cream products for branch plant at Niagara Falls.

N. Y., Buffalo—Lewis Electric Mfg. Co., 1400 Niagara St.—machinery and equipment for the manufacture of mechanical appliances.

N. Y., Buffalo—Seneca Iron & Steel Co., Erie County Bank Bldg.—machinery and equipment for addition to steel works at Blasdell.

N. Y., Cayuta—F. Vandrack, Jr.—one No. 11 or 12 power cutting machine.

N. Y., Chatham—Chatham Courier Co.—power saw with guides, suitable for sawing slugs or solid type-high casts.

N. Y., Cohocton—Wetmiller Dairy & Farm Products Co.—butter making machinery for proposed dairy.

N. Y., Elmira—James Mfg. Co., 700 Madison Ave., (manufacturer of farm equipment, silos, staunchions, etc.)—machinery and equipment for addition to plant.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Electrolytic copper quoted at 14½c. as against 14⅜c. per lb. in New York warehouses; copper market, generally, more stabilized. Tin showing betterment in buying; quoted at 38c. as compared with 36⅞c., last week. Zinc advanced to 8c. as against 7⅝c. per lb. Linseed oil firmer, with no change in quotations. Improvement also shown in lard oils.

Declines—Coke and pig-iron prices, softer. Basic and No. 2 foundry iron down $2.50; now $25 per ton at Pittsburgh, including freight from valley. Steel shapes quoted at minimum of $1.90 per 100 lb., Pittsburgh, for delivery in first quarter of 1923; as high as $2.10, however, has been quoted on orders for immediate shipment. Plate tonnages not being placed so readily; quotations now $1.90@$2 per 100 lb., at mill. Plate buying mostly for tank construction and railway use. Bars, $1.90 for first quarter delivery; current business still at $2 per 100 lb.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.55
Northern Basic	28.27
Southern Ohio No. 2	29.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	32.44
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.64
Virginia No. 2	33.17
Basic	28.00
Grey Forge	28.64
CHICAGO	
No. 2 Foundry local	28.50
No. 2 Foundry, Southern (silicon 2.25@2.75)	28.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	30.00

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cincinnati	4.5@6
New York	5.5
Chicago	4@5
Cleveland	2.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	4.19	3.70	4.00
No. 12	2.60	4.24	3.75	4.05
No. 14	2.70	4.29	3.80	4.10
No. 16	2.90	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20@3.35	4.70	4.20	4.70
Nos. 22 and 24.	3.25@3.40	4.75	4.25	4.70
Nos. 25 and 26.	3.30@3.45	4.80	4.30	4.75
No. 28	3.35@3.50	4.90	4.40	4.85
Galvanized				
Nos. 10 and 11.	3.35@3.50	4.90	4.40	4.85
Nos. 12 and 14.	3.45@3.60	5.00	4.50	4.95
Nos. 17 and 21.	3.75@3.90	5.30	4.80	....
Nos. 22 and 24.	3.90@4.05	5.45	4.95	5.40
No. 26	4.05@4.20	5.60	5.10	5.55
No. 28	4.35@4.50	5.90	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
3/32	8.00		12@13
1/8	6.50		11@12
5/32 to 1/4	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.50
Tin, 5-ton lots, New York	38.00
Lead (up to carlots), St. Louis.....6.95@7.00; New York.	7.45
Zinc (up to carlots), St. Louis......7.30@7.35; New York.	8.00

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7@7.25	8.50	7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.75	20.00
Babbitt metal (83% tin)	35.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.50	9.25
Brass, light	6.00	5.50	6 00
No. 1 yellow brass turnings	6.50	6.50	7.00
Zinc	3 00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.00	11.00	14.50
IC,		112 sheets	12.30	11.40	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	\$0.09@\$0.11½	\$0.12	\$0.11½
Cotton waste, mixed, per b.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.90	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.65	
Coke, prompt furnace, Connellsville... per net ton		\$7.25@7.50	
Coke, prompt foundry, Connellsville... per net ton		7.50@8.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	\$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	\$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	70%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ⅝ in., per 100 lb. (net)	\$6.00	\$3.50	\$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	\$5.00	\$3.90	\$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1¼ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	......	\$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	\$0.50	\$0.50	\$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., \$2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	\$5.84	\$5.84	\$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

N. Y., Elmira—H. Sutter, 428 Erie St.—machinery for the manufacture of radio apparatus and appliances.

N. Y., Hornell—Dewitt Borg Co., (manufacturer of silk)—machinery and equipment for branch plant at Perry.

N. Y., Lockport—W. B. Ellis—machinery and equipment for the manufacture of automobile gears and transmissions.

N. Y., Lockport—Plasters News Co., 31 Locust St.—one tinner's complete outfit.

N. Y., Mount Morris—Bd. Educ.—vocational equipment for $100,000 manual training school.

N. Y., New York—Bristol Co., 340 East 38th St., (manufacturer of furniture)—steel veneer presses and several sizes of iron clamps.

N. Y., Owego—Bd. Educ.—vocational equipment for $275,000 high school.

N. Y., Penn Yan—Milo Ribbon & Carbon Co.—one 32 in. paper cutting machine.

N. Y., Rochester—M. Bednar, 42 University Ave.—one printing press with complete outfit.

N. Y., Rochester—Eastman Kodak Co., Kodak Park—machinery and equipment for refrigeration plant.

N. Y., Rochester—Wood Specialties, Inc., 124 Railroad St.—one automatic cutoff saw.

N. Y., Yonkers—Neidich Co., 247 South Bway.—test bench to test generators and starters.

N. C., Gastonia—H. H. Groves—equipment for proposed cotton mill for the manufacture of fine combed yarns.

N. C., Gold Hill—Rodrain Electro-Metallurgical Co.—machinery and equipment, including conveyors, transmission machinery, etc., for proposed gold mining plant.

O., Cleveland—The city, Comr. of Purchases, City Hall—one 10 ton traveling electric crane with switchboard, switchboard wiring and electric valve controls.

O., Cleveland—Iten Fibre Co., 2359 East 67th St.—one or more hand screw machines, 1 in. capacity (used).

O., Columbus—Mathews Lumber Mfg. Co., 500 South Central Ave., W. A. Mathews, Secy. and Genl. Mgr.—molding machine, cutoff saw and other equipment for lumber mill.

O., Dayton — The Advance Fdry. Co., Parnell St.—10 to 15 ton electric crane, 40 ft. span (used).

O., Dayton — Crawford, McGregor & Canby Co., Albany St., (manufacturer of golf clubs, etc.)—machinery and equipment for $50,000 addition to plant.

O., Elyria—Colson & Co. (manufacturer of juvenile vehicles, etc.)—machinery and equipment for branch plant at Baltimore, Md.

O., Fostoria—Seneca Wire & Mfg. Co.—machinery and equipment for addition to wire products plant.

O, Middletown—Amer. Rolling Mill Co., Curtis Ave.—one alligator shear.

O., Wadsworth — Ohio Match Co.—machinery and equipment for addition to plant for the manufacture of matches, etc.

O., Youngstown—Federal Iron Wks., 70-76 Prospect St., (fabricaters, steel bridge timbers, fire escapes, etc.)—machinery and equipment to replace that which was destroyed by fire.

O., Youngstown—Ravinson Mantel Co., 70-76 South Prospect St., (manufacturer of mantels)—machinery and equipment to replace that which was destroyed by fire.

Okla., Tulsa—McCallum-Morris Electric Co. (manufacturer of electric fixtures), A. McCallum, Purch. Agt.—power job printing press, belting, hangers, pulleys and bearings (used preferred).

Ore., Medford—W. E. Sterns—machinery and equipment for proposed cold storage plant.

Ore., Portland—See-Der Mfg. Co., Larabee and Delay Sts.—complete line of planers, shapers, bandsaws, Universal wood worker, belting and shafting for proposed factory, for the manufacture of cedar chests, furniture and wood novelties.

Pa., Albion—N. Horton—blacksmith shop equipment.

Pa., Allentown — Independent Oil Co., Inc., Rialto Bldg.—machinery and equipment for oil plant on 12th St., to replace that which was destroyed by fire.

Pa., Allentown—Traylor Eng. & Mfg. Co.—castings for 60 in. gyratory crusher.

Pa., Blawnox—The Blawnox Co does not intend to purchase a 10 ton crane, as stated in our issue of Nov. 23.

Pa., Clairton—Bd. Educ., C. A. Bauman, Secy., 415 Caldwell St.—equipment for vocational department of proposed $350,000 Junior and Senior High School.

Pa., Meadville—C. L. Craine—machinery and equipment for the manufacture of patented arch supporters for shoes.

Pa., Narberth — Bd. Educ — vocational equipment for $165,000 school.

Pa., Norwood—Pennsylvania Equipment Co.—25 ton, 45 ft. boom, 8 wheel locomotive crane, equipped with clamshell bucket.

Pa., Phila.—Midvale Steel & Ordnance Corp., Widener Bldg.—alligator shear for Coatesville works.

Pa., Pittsburgh—Young Paper Mfg. Co., 245 1st Ave., (manufacturer of roofing and tarred felts)—machinery to replace that which was destroyed by fire.

Pa., Ridgway—Hyde Murphy Co., (manufacturer of planing mill products)—additional machinery and equipment for new $25,000 plant.

Pa., Rochester—Rochester Rubber Products Co., M. M. Goettman, Treas.—machinery and equipment for the manufacture of tires, tubes and other rubber products.

Pa., Sheffield—I. Ewan—machinery and equipment for the manufacture of patented baseball playing machine at Atlantic City, N. J.

Pa., Springfield—(Cumberland County)—Bd. Educ.—vocational equipment for $200,000 high school.

Pa., Wilkes-Barre—A. Hildebrand, 91 Wood St.—machinery and equipment for lumber and planing mill to replace that which was destroyed by fire.

Pa., Williamsport — Eureka Paper Box Co., Howard Ave. and Canal St.—machinery and equipment for paper box factory.

Pa., Williamsport—A. B. Faulkner, 720 5th Ave.—machinery for the manufacture of automatic illuminating changeable electric signs.

R. I., Providence—Goldberger & Brody, c/o G. Wolf, Archt., 88 Althea St.—equipment for proposed $55,000 garage on Pearl St.

Tenn., Chattanooga — Fountain City Lumber Co., J. V. Brantley, Secy.—machinery for the manufacture of automobile bodies.

Tenn., Harrogate—Lincoln Memorial University—power molding machine, power mixing machine, belting, hangers, pulleys and bake oven, for bakery.

Tenn., Memphis—W. C. Ellis & Sons Iron Wks., 235-245 South Front St., (heavy iron works, grease and oil machinery and manufacturer of warehouse trucks), H. C. Ellis, Secy. and Mgr.—machinery for plant.

Tenn., Morristown—J. P. Nanney Lumber Co.—24 in. four-side planer and matcher with Shimer heads; chain mortiser for doors and sash; single end tenonner; 12 or 16 in. jointer; 36 in. band saw; circular saw (motor driven machines preferred).

Tenn., Nashville—Southern Door & Glass Co., 218-220 North 2nd Ave., B. R. Patterson, Pres. and Treas.—complete woodworking machinery for small sash and door factory.

Tex., Bells—Jolly (newspaper)—10 x 15 in. Miller press, 6 quarto cylinder folder and Meistang mailer.

Tex., Colorado—T. Hughes, (cleaning plant)—tumbler, dry cleaner, cleaner, still, extractor, oil storage system, belting, hangers and bearings.

Tex., Lamesa — City Blacksmith Shop, Box 603—trip hammer for power equipment.

Tex., Sherman—Buffalo Refining Co.—additional oil refining machinery and equipment.

Tex., Sherman—J. T. Cobb, (manufacturer of soap)—soap press.

Va., Martinsville—A. D. Witten—furniture and woodworking machinery and equipment.

Va., Richmond—G. R. Graveley—machinery and equipment for proposed plant for the manufacture of auto tractors and agricultural equipment at Nansemond (Suffolk P. O.).

W. Va., Fairmont—Imperial Ice Cream Co., G. Strong, Pres.—ice and refrigeration machinery.

W. Va., Kenova—Morgan Bros. Lumber Co.—complete machinery and equipment for the manufacture of hardwood flooring.

W. Va., Lost Creek—Vulcan Coal Co., J. Quinn, Supt.—conveying and mining machinery.

W. Va., Morgantown—Shriver Coal Co., E. Bier, Pres.—mining machinery.

W. Va., Roderfield—Baldwin Pocahontas Coal Co.—tipple and conveying machinery for new mining field.

W. Va., Warwood—Contre Fdry. & Machine Co.—foundry and machine shop equipment.

W. Va., Williamson—G. B. Irvine—lumber mill machinery and equipment.

Wis., Appleton—Milhaupt Spring & Auto Co.—machinery and equipment for general automobile repairs; also for the manufacture of springs.

Wis., Cedar Grove—School District No. 1, M. J. De Master, Clk.—manual training equipment for new school.

Wis., Green Bay—Farmer-Labor Publishing Co., c/o F. H. Shoemaker, Box 34—presses and stereotyping outfit.

Wis., Jefferson—C. Baumann—special machinery for the manufacture of chocolate bars.

Wis., Milwaukee—Atherton Eng. Co., c/o M. H. Fuldheim, 425 East Water St.—machinery for the manufacture of radio supplies.

Wis., Milwaukee—A. Bergenthal, 83 Buffalo St.—power driven refrigeration machinery.

Wis., Milwaukee — Cahill & Douglas, Engrs., 217 West Water St.—2 ton ice machine.

Wis., Milwaukee—Midwest Rolling Mills, c/o J. E. Kiefer, 835 Caswell Block—rolling mill equipment for the manufacture of seamless brass and tubing.

Wis., Milwaukee—G. A. Mixer, 1394 Green Bay Ave., (publisher) — presses; lithographing and stereotyping equipment; also linotype machines.

Wis., Peshtigo—Thompson Bros. Boat Co.—additional metal and woodworking machinery for the manufacture of boats.

Wis., Stevens Point—Whiting-Plover Paper Co.—pulp beaters for addition to beater room at Plover.

Ont., West Flamborough—J. Stutt & Sons—lumber and saw mill equipment.

Que., Montreal—Machine Builders, Ltd., 738 St. Paul St., W.—printing, bookbinding and paper box machinery.

Que., Montreal—W. O'Brien, 600 Mullin St.—complete equipment for small foundry.

Metal Working Shops

Calif., Emeryville — The Westinghouse Electric & Mfg. Co., 1st Natl. Bank Bldg., San Francisco, is having plans prepared for the construction of a manufacturing plant on a 12½ acre site, here. Estimated cost $1,000,000. Engr. Dept. of owners, Union Bldg., Pittsburgh, Pa., Engrs. and Archts.

Calif., Fresno—R. Emirzian, 1002 T St., awarded the contract for the construction of a 1 story garage on Block 99, Lots 27 to 32. Estimated cost $39,765.

Calif., Oakland — The Union Press & Forge Co., Ford St. near Derby St., awarded the contract for the construction of a 1 story forge shop. Estimated cost $6,500.

Calif., Sacramento—The Sacramento Pipe Wks., R St. near 7th St., plans to build a plant consisting of 2 buildings, each 148 x 230 ft., on 16th and B Sts.

Calif., San Francisco—The Bothin Real Estate Co., 604 Mission St., awarded the contract for the construction of a 1 story ornamental iron works on Clementina St. between 5th and 6th Sts. Estimated cost $10,000. Kloeres & Koch, 943 Columbus Ave., lessees.

Calif., San Francisco—J. M. Carlson, 185 Stevenson St., awarded the contract for the construction of a 2 story electrical shop on Minna St. Estimated cost $9,000. Central Electric Co., 185 Stevenson St., lessee.

Calif., San Francisco—L. R. Lurie, Mills Bldg., has had plans prepared for the construction of a 1 story machine shop on 10th and Minna Sts. Estimated cost $15,000. O'Brien Bros., Inc., 240 Montgomery St., Archts.

Calif., San Francisco—S. C. Moore, 133 Kearny St., awarded the contract for the construction of a 1 story, 30 x 110 ft. plating shop on Folsom St. near 19th St. Estimated cost $5,000.

Conn., Fairfield—S. Lowe & Sons Co., 30 Sunfield Drive, awarded the contract for the construction of a 2 story, 45 x 80 ft. addition to its factory for the manufacture of sash pulleys. Estimated cost $25,000. Noted Nov. 16.

Conn., Hartford—Hartford Dispatch & Trucking Co., 105 Albany Ave., will build a 1 story, 40 x 80 ft. garage and machine shop. Estimated cost $40,000.

Conn., Southington—The Stanley Rule & Level Co., New Britain, will build a 1 story, 60 x 60 ft. addition to its forge shop on Sumier St., here. Estimated cost $15,000.

Ill., Chicago — The Fair Department Store, State and Adams Sts., awarded the contract for the construction of a 1 story, 157 x 313 ft. garage at 2454-2520 Lawrence Ave. Estimated cost $185,000.

Ill., Chicago—Ford Motor Co., Highland Park, Mich., is having plans prepared for the construction of a 1 story, 502 x 1,363 ft. assembly plant for automobiles on Torrance Ave. and Calumet River, here. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Ill., Chicago—The Golden Rule Cutlery Co., Ogden and Sheldon Sts., awarded the contract for the construction of a 3 and 4 story factory. Estimated cost $20,000. Noted Nov. 23.

Ill., Chicago—Muehlhausen Spring Co., 5841 Loomis St., is receiving bids for the construction of a 1 story, 100 x 142 ft. factory for the manufacture of phonograph springs, at 5811-19 South Western Ave. Estimated cost $40,000. Newhouse & Bernhams, 4630 Prairie Ave., Archts.

Ill., Chicago—The Peoples Gas Light & Coke Co., 172 South Michigan Ave., is having plans prepared for the construction of a 2, 3 and 4 story meter repair shop on Homan and Division Sts. Estimated cost $300,000. H. Von Holst, 112 West Adams St., Archt.

Ill., Oak Park—The Madison Motor Co., 810 West Madison St., is having plans prepared for the construction of a 1 story automobile sales and service station at 811 West Madison St. Estimated cost $60,000. Weller & Rippel, 140 South Dearborn St., Chicago, Archts.

Ky., Louisville—The Louisville Garage Co. plans to build a garage and service station on 5th St. Estimated cost $100,000. Architect not announced.

La., Baton Rouge—Louisiana State University will soon award the contract for the construction of a power house, also for an engineering building, 325 ft. long, with 4 wings, each 100 ft. long. Estimated cost $130,000. R. L. Himes, Secy. Building Com.

Mass., Worcester—The Parker Wire Goods Co., 18 Grafton St., awarded the contract for the construction of a 1 story, 120 x 300 ft. wire goods manufacturing plant. Estimated cost $75,000. Noted Nov. 16.

Mass., Worcester — Reed & Prince Mfg. Co., Duncan Ave., awarded the contract for the construction of a 2 story, 60 x 400 ft. addition to factory for the manufacture of screw products, also a 1 story, 90 x 120 ft. annealing room on Nixon Ave. Estimated cost $150,000.

Mich., Detroit—The Michigan Stamping Co., 11631 Mack Ave., had plans prepared for the construction of a 1 story, 140 x 347 ft. addition to its metal stamping plant. Estimated cost $175,000. A. Kahn, 1000 Marquette Bldg., Archt.

Mo., St. Louis—The city, Bd. of Public Service, 208 City Hall, will receive bids until Jan. 2 for the construction of a 2 story, 54 x 225 ft. service building and power plant for St. Louis Training School for Feeble Minded at Scott Farm. Estimated cost $150,000. L. R. Bowen, 304 City Hall, Engr. and Archt.

Mo., St. Louis—F. L. Cornwell, La Salle Bldg., is building a 3 story, 78 x 155 ft. automobile garage and show room on Locust Blvd. Estimated cost $150,000.

Mo., St. Louis—J. Cusamano, 910 Carleton Bldg., awarded the contract for the construction of a 1 story, 127 x 192 ft. garage on 10th St. Estimated cost $40,000.

Mo., St. Louis—H. Foerster, 3539A Giles Ave., awarded the contract for the construction of a 1 story, 50 x 140 ft. iron works at 3907 Bingham St. Estimated cost $25,000.

N. Y., Blasdell—The Seneca Iron & Steel Co., Erie County Bank Bldg., Buffalo, plans to build a large addition to its steel and iron works on a 15 acre site, here. Cost will exceed $50,000. Architect not announced.

N. Y., Brooklyn—J. J. Aaron, c/o A. Goldberg, Engr. and Archt., 164 Montague St., will build a 1 story, 100 x 150 ft. garage on Montgomery St. Estimated cost $75,000.

N. Y., Buffalo—A. L. Dixon, 1034 Main St., plans to build a 2 story, 98 x 200 ft. automobile sales building and garage. Cost will exceed $40,000. Architect not announced.

N. Y., Buffalo—M. Finkelstein, 255 Amherst St., plans to build a garage and service station. Estimated cost $80,000. Architect not announced.

N. Y., Buffalo—The Swan Garage, Inc., 48 Swan St., awarded the contract for the construction of a 3 story, 91 x 115 ft. garage. Noted Nov. 16.

N. Y., New York—The Dept. of Parks, Municipal Bldg., is having plans prepared for the construction of a 4 story service building on 77th St. and Columbus Ave. Estimated cost $500,000. Private plans.

N. C., Gold Hill—The Rodrain Electro-Metallurgical Co. plans to build a complete gold mining plant. Estimated cost $500,000. Architect not announced.

O., Akron—The Ohio Pump & Machine Co., National Bldg., awarded the contract for the construction of a 1 and 2 story, 80 x 260 ft. plant. Estimated cost $50,000.

O., Alliance—The Machined Steel Castings Co., South Mahoning Ave., plans to build a 1 story, 75 x 200 ft. addition to its plant. Estimated cost $100,000.

O., Cleveland—G. W. Deming, 3154 Redwood Ave., and O. G. Deming, 1269 Carlyon Rd., Cleveland Heights (real estate), are having plans prepared for the construction of a 1 story, 40 x 73 ft. and 40 x 54 ft. commercial building and garage on Euclid Ave. and Chardon Rd. Estimated cost $40,000. H. P. Whitworth, 526 Hickox Bldg., Archt.

O., Cleveland—The Grabler Mfg. Co., 6565 Bway., manufacturer of plumbing supplies, awarded the contract for the construction of a 1 story, 50 x 80 ft. and a 3 story, 80 x 80 ft. annealing house and factory. Estimated cost $50,000. W. S. Bayer, Secy. Noted Oct. 5.

O., Cleveland—A. Mechanic, 7829 Carnegie Ave., manufacturer of automobile accessories, is having plans prepared for the construction of a 2 story, 33 x 37 ft. shop on East 82nd St. and Carnegie Ave. Estimated cost $25,000. A. Sogg, 319 Hippodrome Bldg., Archt.

O., Cleveland—The W. S. Tyler Co., 1430 East 36th St., awarded the contract for the construction of a 1 story, 40 x 60 ft. addition to its galvanizing plant. Estimated cost $10,000.

O., Cleveland—The Union Terminal Bus Line Co., c/o Miller & James, Archts., Erie Bldg., is having plans prepared for the construction of a 2 story, 72 x 180 ft. garage and service station on East 9th St. near Central Ave. Estimated cost $60,000.

O., Wadsworth—The Ohio Injector Co., c/o E. J. Young, Pres., is having plans prepared for the construction of a 3 story, 60 x 250 ft. addition to its factory. Estimated cost $150,000. Christian-Schwarzenberg & Gaede Co., 1900 Euclid Ave., Cleveland, Archts.

Pa., East Newport (Newport P. O.)—The Mineral Products Co. plans to rebuild portion of its roofing products plant, which was destroyed by fire. Estimated cost $25,000.

Pa., Fleetwood—The Down Tool Wks. is building a 1 story, 36 x 134 ft. and 24 x 37 ft. factory for the manufacture of high speed drills and tools, on Locust St. Estimated cost $10,000. W. R. Down, owner.

Pa., Phila.—The Franklin Sugar Co., 1045 North Delaware Ave., plans to build a 1 and 2 story machine shop and barrel house. Estimated cost $50,000. Private plans.

Pa., Phila.—C. J. Gilmore, Archt., Fuller Bldg., is receiving bids for the construction of a 1 story, 62 x 155 ft. garage on York Rd. and City Line Ave., for W. B. Margerum, York Rd. and Chelen Ave. Estimated cost $60,000.

Pa., Phila.—F. Nardy, 3840 Spring Garden St., is having plans prepared for the construction of a 2 story, 100 x 138 ft. garage on 18th and Jackson Sts. Estimated cost $80,000. R. A. Schuman, 202 West State St., Trenton, N. J., Archt.

Pa., Phila. — The Smith-Hardican Co., 1606 Cherry St., is receiving bids for the construction of a 4 story, 65 x 80 ft. garage on 20th and Brandywine Sts. Estimated cost $120,000. Private plans.

Pa., Pittsburgh—The Fairmont Creamery Co., 301 Ferry St., awarded the contract for the construction of a 1, 2 and 5 story, 62 x 72 ft. and 38 x 72 ft. sales warehouse and garage on 25th and Smallman Sts. Estimated cost $150,000. Noted Sept. 14.

Wis., Waupun—Landaal Bros. Co. plans to build a 1 or 2 story, 60 x 132 ft. garage on Drummond St. Estimated cost $50,000. Architect not selected.

Wis., Wausau—The Hall Garage Co., 107 Scott St., awarded the contract for the construction of a 2 story, 50 x 60 ft. garage. Estimated cost $40,000.

Ont., Bridgeburg — The National Brake Co., Ellicott Bldg., Buffalo, N. Y., plans to build a branch plant for the manufacture of brakes and equipment, here.

Ont., Collingwood—The Canadian Postal Lock Nut Bolt Co., plans to build a factory for the manufacture of bolts, screws, rivets and also for steel stamping, in the spring. Estimated cost $50,000. F. A. Bassett, Mgr.

Ont., Ford—Ford Motor Co. of Canada, awarded the contract for the construction of a 2 story, 100 x 400 ft. automobile factory on Riverfront St. Estimated cost $250,000. P. W. Grandjean, Secy.

Ont., Wiarton — G. Golden, Berford St., plans to build a garage and automobile repair shop. Estimated cost $45,000.

Pa., Warren — The Warren Garage Co. plans to remodel and build a 2 story addition to its garage.

Pa., Waynesburg — H. Cochrane, Dawson, will build a 2 story, 90 x 120 ft. garage on Greene St. Estimated cost $60,000.

R. I., Providence—G. Wolf, Archt., 88 Althea St., is receiving bids for the construction of a 2 story, 50 x 120 ft. garage on Pearl St. for Goldberger & Brody, c/o Archt. Estimated cost $55,000.

Tenn., Chattanooga — The Continental Mchy. Co., G St., plans to rebuild its plant for the manufacture of machinery, which was recently destroyed by fire. Estimated cost $200,000. Architect not announced.

Tenn., Memphis — The Fischer Heating Co., 51 South 3rd St., awarded the contract for the construction of a 1 and 2 story machine shop, industrial and heating plant, on a 75 x 150 ft. lot. Estimated cost $35,000.

Va., Nansemond (Suffolk, P. O.)—G. D. Graveley, Richmond, plans to build a plant for the manufacture of auto tractors and agricultural equipment, here. Estimated cost $25,000. Architect not announced.

Wis., Eau Claire—K. N. Knudson, 307 North Farwell St., plans to build a 1 story, 55 x 94 ft. garage. Estimated cost $40,000. Private plans.

Wis., Eau Claire—The Paige-Ford Motor Car Co., Wisconsin and North Farwell Sts., plans to build a 2 story, 58 x 90 ft. garage. Estimated cost $45,000. Private plans.

Wis., Milwaukee—H. C. Hengels, Archt., 445 Milwaukee St., is receiving bids for the construction of a 2 story, 70 x 150 ft. addition to garage on Grand Ave., for the Welch Investment Co., 105 Wells St. Estimated cost $50,000.

General Manufacturing

Calif., Hayward—E. L. Macabee, Mgr. Hunt Bros. Packing Co., Lower B St., and Chn. of Cold Storage Plant Committee of Hayward Chamber of Commerce, backs movement to finance construction of cold storage plant. Will be constructed either by the formation of a local stock company or b ya corporation already established in Hayward. Estimated cost $100,000.

Calif., Oakland—The Art Rattan Wks., 475 Sutter St., San Francisco, plans to build a 3 story factory for the manufacture of rattan furniture on 24th Ave., here. Estimated cost $20,000.

Calif., Porterville—The Acme Ice Cream Co., 1313 Sansome St., San Francisco, has purchased a creamery plant, here, and plans to remodel and build additions to same, including an ice plant.

Conn., Bridgeport — A. V. Langenegger, 2190 Park Ave., is having plans prepared for the construction of a 3 story factory for the manufacture of corsets on Federal St. Estimated cost $150,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Archts.

Conn., Hartford—The Hartford City Gas Light Co., 565 Main St., plans to build a large addition to its gas plant. Architect not selected.

Conn., Hartford—The Hartford Courant, 64 State St., awarded the contract for the construction of a 2 story addition to its plant, to be used for a printing and mailing room. Estimated cost $50,000. Noted Nov. 23.

Conn., Westport—The Lees Mfg. Co., 320 Bway, New York City, is having plans prepared for the construction of a 3 story, 50 x 150 ft. addition to its cordage and twine factory, here. Estimated cost $75,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Archts.

Ill., Chicago—The Douglas Bottling Co., 3523 Ogden Ave., awarded the contract for the construction of a 1 and 2 story, 75 x 145 ft. and 23 x 75 ft. bottling works on Ogden Ave. near South Ridgeway St. Estimated cost $40,000.

Ill., Chicago—D. P. Farrell, c/o M. O. Nathan, Archt., 123 West Madison St.,

awarded the contract for the construction of a 1 story, 100 x 200 ft. box factory at 4411 West Lake St. Estimated cost $40,000.

Ill., Chicago — The Olson Rug Co., 32 Laflin St., awarded the contract for the construction of the foundation of a 5 story, 84 x 187 ft. factory at 1514-20 West Monroe St. Estimated cost $250,000. Noted Oct. 12.

Ind., New Albany—The Period Cabinet Mfg. Co. plans to build an addition to its furniture factory. Estimated cost $25,000.

Md., Baltimore—The Air Reduction Co., 342 MadisonAve., New York City, is having plans prepared for the construction of an acetylene plant on Fayette St. ,here. Estimated cost $150,000. Francisco & Jacobus, 511 5th Ave., New York City, Archts.

Mass., Bridgewater—The Lapworth Webbing Co., Stoughton, will build a 1 story elastic webbing plant, here. Estimated cost $30,000.

Mass., Fall River—The Standard Oil Co., 26 Bway, New York City, awarded the contract for the construction of a 1 story oil plant, consisting of a 61 x 83 ft. garage, a 20 x 20 ft. pump house, a 30 x 51 ft. warehouse, storage tanks, etc., on Slade St., here. Estimated cost $50,000.

Mass., Lawrence — The Bellevue Monumental Wks., 64 Manchester St., manufacturer of marble monuments, will build a 2 story, 40 x 53 ft. addition to its plant. Estimated cost $20,000.

Mass., Millbury—The Samuel E. Hull Co., 112 Front St., Worcester, awarded the contract for the construction of a 2 story, 55 x 60 ft. shoddy mill, here. Estimated cost $25,000.

Mass., North Brookfield — The Asbestos Textile Co., Woolworth Bldg., New York City, awarded the contract for the construction of a 1 story, 30 x 50 ft. addition to its textile plant, here. Estimated cost $7,500.

Mass., Worcester—The Waldorf System, Inc., 169 High St., Boston, awarded the contract for the construction of a 1 story, 65 x 125 ft. bakery, commissary, etc., on Arch and Sumner Sts., here. Estimated cost, $40,000. Noted Oct. 5.

Minn., Duluth—The Blue Valley Creamery Co., 700 South Clinton St., Chicago, awarded the contract for the construction of a 2 story, 90 x 100 ft. creamery on Commerce St. and 12th Ave., W., here. Estimated cost $35,000.

Mo., St. Louis—The Broderick & Bascom Rope Co., 805 North Main St., awarded the contract for the construction of a 2 story, 81 x 496 ft. warehouse at 4233-35 North Union Blvd. and a 1 story, 143 x 496 ft. factory at 4239-51 North Union Blvd., also smaller building. Estimated cost $188,350.

Mo., St. Louis—The Grace Sign & Mfg. Co., 425 South Main St., plans to build a 1 story, 150 x 260 ft. sign factory on 2nd and President Sts. Estimated cost $100,000. Architect not selected.

N. Y., Alden—Bd. of Supervisors, Erie County, City Hall, Buffalo, is having preliminary sketches made for the construction of a 1 story, 75 x 100 ft. power house and refrigerating plant in connection with the new county home, here. Cost will exceed $40,000. W. A. Kidd, 524 Franklin St., Buffalo, Archt.

N. Y., Ashville—W. F. Meyer plans to rebuild cider mill which was recently destroyed by fire. Estimated cost $10,000.

N. Y., Buffalo—The Automatic Tire Machine Co., 19 Bush St., plans to build a factory for the manufacture of tire machines and appliances. Estimated cost $12,800.

N. Y., Geneva—City plans an election to vote on a $500,000 bond issue for the construction of a high school, including vocational department. C. W. Rice, Pres.

N. Y., Jamestown—The Six Hundred Gas Stations, Inc., 8th St., awarded the contract for the construction of a 2 story, 40 x 60 ft. gasoline distributing station on Monroe and 8th Sts. Estimated cost $25,000. Noted Sept. 28.

N. Y., New York—Harper & Bros., 338 Pearl St., will soon receive bids for the construction of a 5 story publishing building on East 33rd St. Estimated cost $800,000. Warren & Wetmore, 16 East 47th St., Engrs. and Archts.

N. Y., White Plains—Dentermann & Son Ice Co. is having plans prepared for the construction of a 1 story, 50 x 120 ft. addition to its plant. Estimated cost $65,000. L. Block, 501 5th Ave., New York City, Archt.

N. C., Cramerton—Mays Mill, Inc., plans to build a weaving mill addition to its plant for the manufacture of yarns into fancy finished colored goods, capacity 2,000 looms. Estimated cost $1,000,000. S. W. Cramer. Pres.

N. C., Lillington—The Cape Fear Gravel Pits, Inc., plans to build a large gravel production plant, also a plant for the manufacture of concrete building blocks and tile. Estimated cost $250,000. C. W. Lacy, Wilmington, Pres.

O., Cleveland—H. E. Roth, 1604 East 117th St., has had plans prepared for the construction of a 1 story, 50 x 100 ft. and 30 x 40 ft. hide factory, office and garage, on West 65th St. near Storer Ave. Estimated cost $50,000.

O., Wadsworth—The Ohio Match Co. is having plans prepared for the construction of a 3 story, 120 x 200 ft. factory. Estimated cost $150,000. Christian-Schwarzenberg & Gaede Co., 1900 Euclid Ave., Cleveland, Archts.

Pa., Allentown—The Trenton Poster Advertising Co., 725 East State St., Trenton, N. J., awarded the contract for the construction of a 1 story, 60 x 125 ft. poster advertising works, here. Estimated cost $20,000.

Pa., Bridgeport—James Lees & Sons Co. awarded the contract for the construction of a 5 story, 43 x 64 ft. textile mill.

Pa., Erie — The Record Publishing Co., 12th and French Sts., plans to build an addition to its printing plant. Estimated cost $9,700.

Pa., Lebanon—The Lebanon Honey Cake Cone Co. plans to build a 2 story factory for the manufacture of cones and byproducts. Cost will exceed $25,000.

Pa., Phila.—The Amer. Ice Co., 6th and Arch Sts., is receiving bids for the construction of a 1 story, 125 x 150 ft. ice storage plant on 17th St. and Washington Ave. Private plans.

Pa., Phila.—Bennett & Aspden Co., Krams and Pechin Sts., awarded the contract for the construction of a 3 story addition to its textile mill for the manufacture of upholstery. Estimated cost $80,000.

Pa., Phila.—Bush & Diamond, Jasper and Thayer Sts., awarded the contract for the construction of a 2 story rug mill on Ontario and Jasper Sts. Estimated cost $50,000.

Pa., Phila.—The Ketterlinus Lithographic Mfg. Co., 4th and Arch Sts., will receive bids Jan. 1 for the construction of an 8 story, 55 x 140 ft. printing plant. Ballinger Co., 12th and Chestnut Sts., Archts. Noted Nov. 23.

Pa., Phila.—The Rodgers Engraving Co., 1318 Arch St., awarded the contract for the construction of a 2 story printing plant on Camac and Cherry Sts. Estimated cost $27,000.

Pa., Phila.—The University of Pennsylvania, 34th and Woodland Sts., awarded the contract for the construction of a 2 story, 34 x 43 ft. laundry on 34th and Spruce Sts. Estimated cost $32,000.

Pa., Phila.—C. E. Wunder, Archt., 1517 Spruce St., is receiving bids for the construction of a 5 story, 173 x 200 ft. printing plant on 34th and Market Sts. for the Stephen Green Co., 15th and Arch Sts. Estimated cost $250,000.

R. I., Pawtucket—Bd. Educ. will soon receive bids for the construction of a 3 story manual training and industrial arts high school on Fountain St. Estimated cost $1,200,000. R. C. N. Monahan, 255 Main St., Archt.

R. I., Woonsocket — The Rhode Island Knitting Co., Jeffers St., will soon award the contract for the construction of a 2 story, 40 x 100 ft. addition to mill for the manufacture of knit goods. Estimated cost $50,000. Private plans. Noted Nov. 30.

R. I., Woonsocket—The Verdun Mfg. Co., Manville Rd., awarded the contract for the construction of a 1 story addition to its textile plant, a 32 x 44 ft. finishing mill and a 26 x 36 ft. garage. Estimated cost $7,500.

Tenn., Memphis—The DeSoto Hardwood Flooring Co., 1014 Sledge Ave., plans to build a 30 x 135 ft. addition to its plant, including dry kilns. Estimated cost $25,000. R. A. Taylor, Mgr.

Va., Front Royal—Proctors Grist Mills plans to rebuild its mill which was recently destroyed by fire. J. J. Proctor, proprietor.

Va., Richmond—The Corley Piano Co., 213 East Broad St., plans to rebuild its factory which was recently destroyed by fire. Estimated loss $235,000.

W. Va., Glen White—E. E. White Coal Co. plans to build a coal tipple. Estimated cost $50,000.

Wis., Crandon—F. H. Himes, plans to build a 50 x 65 ft. saw and planing mill. Architect not selected.

Wis., Eau Claire—The Lang Canning Co., Mill St., will build a 2 and 3 story addition to its cannery, consisting of a main factory, viner and husking buildings, boiler room, garage and sauerkraut factory. Estimated cost $120,000.

Wis., Hustisford — J. Hurley, Hartland, plans to build a 2 story, 75 x 150 ft. creamery and dairy, here. Estimated cost $50,000. Architect not selected.

Wis., La Crosse—The Anderson Vulcanizing Co., 215 State St., will build a 2 story, 30 x 50 ft. vulcanizing station. Estimated cost $15,000.

Wis., Madison—The Madison Supply Co., 615 East Washington Ave., is having plans prepared for the construction of a 2 story, 50 x 60 ft. bottling works and warehouse building. Estimated cost $40,000. R. A. Phillips 315 Beaver Bldg., Archt.

Wis., Madison—The Valvoline Oil Co., 815 East Main St., is receiving bids for the construction of 2 40 x 50 ft. filling stations, including oil storage tanks, pumps, etc., on Lakeside St. Estimated cost $40,000. H. R. Potter, Mgr. A. D. Conover, Tenny Bldg., Archt.

Wis., Milwaukee — The Excel Mfg. Co., 3402 South Pierce St., awarded the contract for the construction of a 2 story, 60 x 180 ft. addition to its mill work factory. Estimated cost $45,000.

Wis., Milwaukee—The Palmolive Co., 42 4th St., (manufacturer of soap) will build a 1 story, 50 x 50 x 80 ft. addition to its factory. Estimated cost $20,000.

Wis., Milwaukee—The Random Lake Ice Co., 064 Locust St., will build a 1 story, 100 x 125 ft. ice manufacturing plant on Walnut St. Estimated cost $50,000.

Wis., Neenah—The Kimberly-Clark Co. awarded the contract for the construction of a 2 story, 65 x 120 ft. addition to its paper mill. Estimated cost $50,000.

Wis., Plover—The Whiting-Plover Paper Co., Stevens Point, awarded the contract for the construction of a 3 story, 40 x 108 ft. paper factory unit and beater room, here. Estimated cost $50,000. E. A. Oberweiser, Mgr.

Wis., Random Lake—The Krier Preserving Co., Belgium, is receiving bids for the construction of a 1 and 2 story, 50 x 240 ft. cannery, consisting of a main factory, warehouse, sheds and power house, here. Estimated cost $100,000. Private plans.

Wis., Sheboygan—The Vulcan Last Co., Crandon, plans to build a 2 story, 75 x 125 ft. shoe factory, here. Architect not selected.

Wis., Wausau — Oppenhamer & Obel, Archts., Spencer Bldg., are receiving bids for the construction of a 3 story, 50 x 180 ft. shoe factory for the Marathon Shoe Co., 1st Ave. and Cedar St. Estimated cost $60,000.

Wyo., Rawlins—The Producers' & Refiners' Co., Caspar, awarded the contract for the construction of a refinery, 10,000 bbl. capacity, on a 2,800 acre site, here.

N. B., St. Johns—The Stephen Brick Co., Prince William St., plans to rebuild its plant which was recently destroyed by fire. Estimated cost $100,000.

Ont., Goderich — W. Baechler plans to build a woodworking plant and sawmill. Estimated cost $50,000.

Ont., Lindsay—The Gull River Lumber Co. plans to build a dry kiln and lumber warehouse.

Ont., Owen Sound — Bd. Educ., W. H. Wright, Chn., awarded the contract for the construction of a 3 story, 100 x 300 ft. technical school on 5th Ave. Estimated cost $200,000. Noted June 8.

Ont., Petrolea—B. P. Corey plans to build factories for the manufacture of grease, oil and gasoline, also tanks for storing raw materials. Estimated cost $100,000.

Ont., Rannoch—W. Zurbrigg, c/o J. H. Jameson, St. Marys, plans to build a saw and planing mill, here. Estimated cost $25,000.

Ont., Stratford — Stratford Frames & Novelties, plans to vote on by law in January for the construction of a factory for the manufacture of various lines of woodwork. Estimated cost $50,000.

Ont., Toronto—Lawrason & Doughty, 42 Church St., awarded the contract for the construction of a 4 story, 80 x 100 ft. paper carton factory. Estimated cost $150,000.

Ont., Welland—The Welland Cotton C. having plans prepared for the construction of a 1 and 2 story, 100 x 350 ft. cotton mill on Bergar St. Estimated cost $250,000. J. T. Grantham, Pres. Private plans.

Que., St. Hyacinthe — Penmans, Ltd., Paris, Ont., is having plans prepared for the construction of a woolen mill on Girouard St., here. Estimated cost $100,000. J. M. Moore, 489 Richmond St., London, Ont., Archt.

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Making Steel Balls

Description of Methods Used by the Atlas Ball Company to Produce Steel Balls—Methods Rather than Skill Produce Desired High Quality

By A. L. De LEEUW
Consulting Editor, *American Machinist*

TO MAKE A STEEL ball which must be so round that the most refined machine shop methods will not be sufficient to discover a deviation from the ideal, which must be made to a given diameter and shall not be more than $\frac{1}{10}$ of a thousandth of an inch oversize or undersize; which must be of extraordinary hardness throughout and which must be finished to such a high degree of polish and perfection that a strong magnifying glass shall not disclose the minutest impression or scratch, would seem quite a task. If such a feat had been accomplished, say 100 years ago, volumes would have been written about so remarkable an accomplishment. To make thousands of such balls, all alike and all of the same degree of perfection would seem to border on the impossible and yet this is the daily task of the Atlas Ball Company of Philadelphia, Pa.

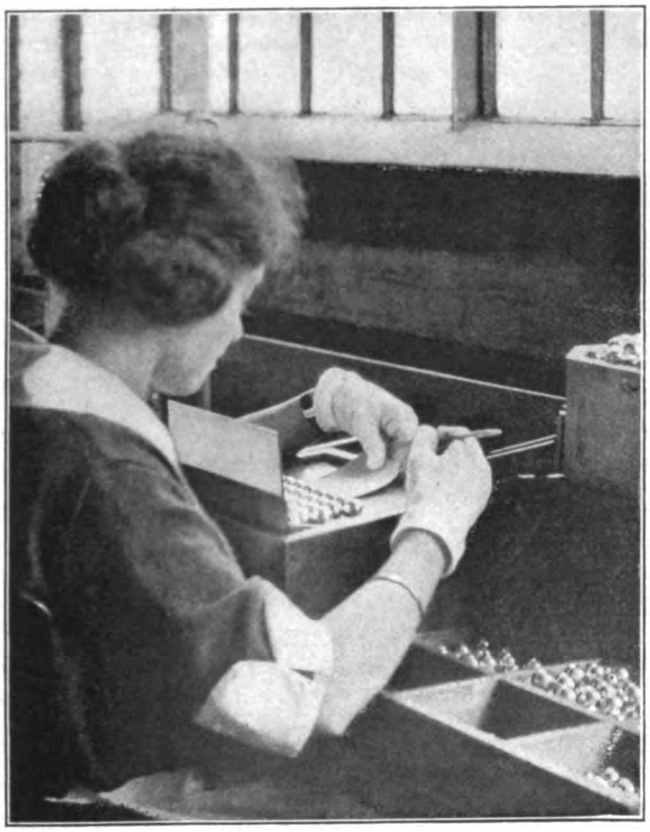


FIG. 1—INSPECTING STEEL BALLS

We are so familiar with steel balls and their use that we fail to appreciate the remarkable qualities they must possess. Like many other things which we meet daily, we take them for granted. Perhaps the most important lesson we can learn when we follow the manufacture of steel balls is, that method and system are of more importance than individual skill and that they can accomplish things which are beyond the ability of an individual. One hundred years ago it would have required a super-mechanic to make only one ball and it is highly improbable that he would have succeeded. Now millions of balls are made, not by skill, not by super-mechanics, but by application of the proper methods and the proper system.

The ordinary method of describing the manufacture of a product is to begin with the material. We propose to reverse this process because what the observer is interested in is the finished ball and probably the first question he will ask himself is: How is it possible that one can be sure that the balls are made to the proper diameter and all alike, if their allowable variations are so exceedingly small? And so we will begin with the inspection.

The girl, shown in Fig. 1, is engaged in the task of inspecting the finished balls. It will be noted that she wears gloves. After the balls have been polished it is not permitted to touch them by hand because, though they may be oiled, the touch of the finger will cause them to corrode, not immediately but some time later.

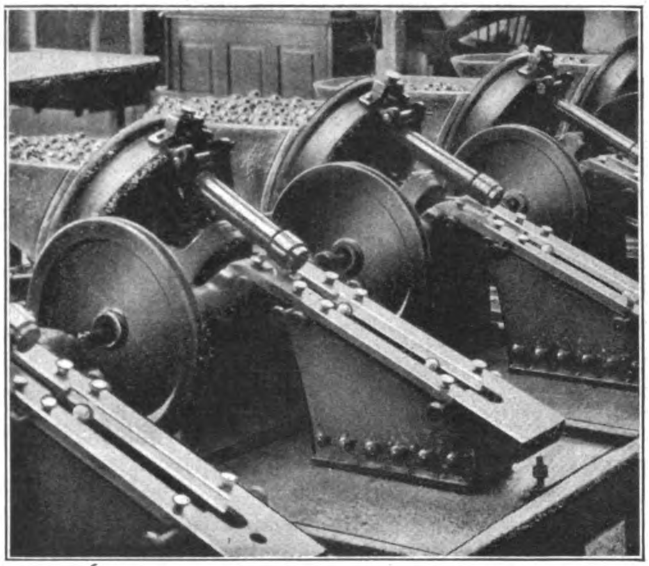


FIG. 2—MECHANICAL GAGING DEVICE

The balls to be inspected are laid on a slightly inclined desk so that a white cardboard placed at the end will throw a bright reflection of light on the balls causing them to appear partly a bright white and partly dark. That portion which is turned toward the card board appears white.

The inspector has another piece of cardboard in her hand which she inserts under the balls causing them to turn. She is constantly moving them so as to expose new parts of their surfaces to the bright reflection. The minutest scratch can be discovered in this manner. Sometimes there is a de-carbonized spot in the ball, a

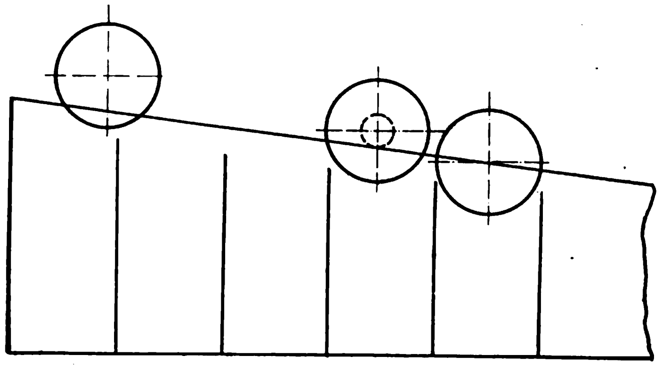


FIG. 3—DIAGRAM SHOWING ACTION OF BALLS, ROLLING DOWN THE INCLINED PLANE OF THE GAGING DEVICE

spot which is not quite so hard as the rest of it. Such a spot appears like a faint cloud. Balls which are not perfect are removed by means of a pencil-like magnet, which the inspector holds in her right hand. When inspecting the smaller balls, she holds a small chamois bag in her hand into which she drops the imperfect balls

It is interesting to watch how the little magnet is manoeuvred. The ball is picked up at one end and lifted

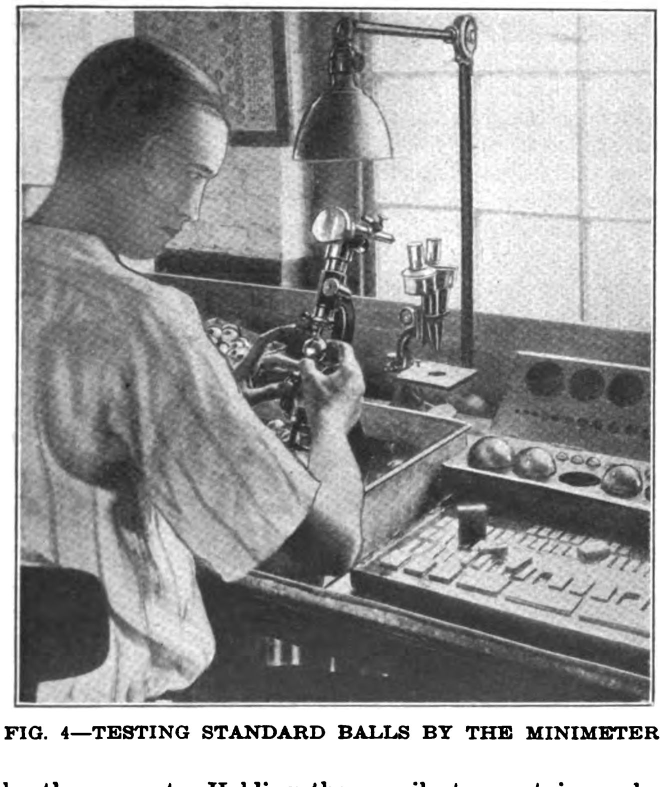


FIG. 4—TESTING STANDARD BALLS BY THE MINIMETER

by the magnet. Holding the pencil at a certain angle, the ball is made to slide along the magnet until it reaches the non-magnetic center when it drops into the open chamois bag. The entire operation goes very quickly. And, by the way, the upright pieces of cardboard are of such a size, and are so placed that the exhaled breath is deflected toward the operator, thus guarding the balls against corrosion.

The balls which are found to be imperfect on inspection may have different degrees of imperfection. There may be a single very small scratch or impression which, of course, makes the ball unfit for this particular size but allows it to be repolished for a somewhat smaller size. It should be remembered that balls are ordered not merely of standard size, such as for instance ¾ in., but that they are often required to be, let us say, ¾ in. plus 0.001, or maybe minus 0.001 in. When the imperfection is slightly deeper grinding may take it out. Whatever is done later on with the imperfect balls they are always followed up as "imperfects" and if it is found that a second grinding does not remove the imperfection, the ball is scrapped.

There are some balls which are merely unsuited for the particular size for which they were intended, others have real defects and must be scrapped. It is for this reason that the inspector is provided with a tray with a number of partitions in which the different kinds of imperfect balls are placed after inspection.

Before the final inspection the balls are measured. All Atlas balls are guaranteed to be not more than 0.00005 in. above or below the desired size. When speaking of the amount of finish left for a certain operation or of the amount of tolerance, the Atlas people speak in tenths of a thousandth so that when they say that a ball should be 20 over-size, it merely means that it should be 0.002 in. larger than the nearest standard size.

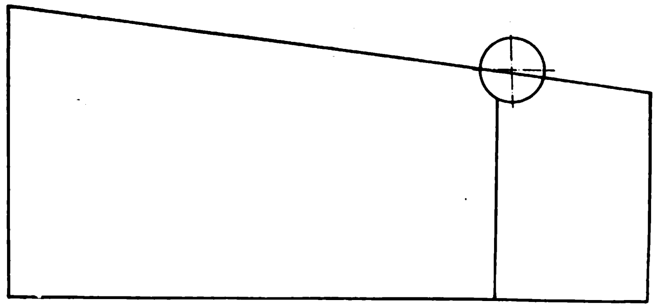


FIG. 5—DIAGRAM SHOWING PRINCIPLE OF GAGING DEVICE AS USED BY THE ATLAS BALL CO.

A common way of sorting balls is to let them run over an inclined plane such as shown in Fig. 2. The plane is made by two beveled straight edges which are set at a slight angle so that the opening at the top is somewhat less than that at the bottom. In some factories balls varying as much as 0.001 are inspected that way and the space under the straight edges is provided with 10 divisions so that if, for instance you were inspecting half-inch balls, a ball of 0.4995 in. would drop at the top of the inclined plane in a compartment; another one which would be exactly ½ in. would drop in the 6th compartment, whereas one of 0.5004 in. diameter would drop in compartment 10. In this manner, it is supposed that the balls in each compartment are of the same nominal diameter and perfectly to size within $\frac{1}{10}$ of a thousandth. This method, however, is not sufficiently refined to be absolutely sure about the correctness of size.

In Fig. 3 the action of the inclined plane is shown in diagrammatic form. When the ball is resting on the inclined plane somewhere near the top, its center is quite some distance above the incline; when it has come to the last compartment, that is, the one in which it will drop, its center is exactly on the incline. On the last but one, the center of the ball is so near the incline that the ball while rolling down turns on an exceedingly small diameter. The small circle shown is the one on which it turns.

We see then that the ball has considerable speed at the upper part of the incline and that, though it has been rolling for some time and might be supposed to have gathered speed, yet it will have exceedingly low speed when it is about to drop through the slot. It is therefore likely that great accuracy will be obtained at the lower end of the inclined plane but that the speed at the upper part is too great to be sure as to the exact compartment in which the ball will drop. Besides, to work correctly, the two straight edges must be very straight, something which is not easy to get or to maintain.

The Atlas Company, realizing these conditions, does not attempt to separate the balls into 10 different sizes. The company starts out by making the balls so nearly correct that the only thing necessary is to apply the "go" and "no-go" gage, in other words, to eliminate those balls which are either too large or too small. For this purpose the inclined plane or rather the two straight edges are set again at a slight taper but there is only one up-right in the box below, thus making two compartments. When setting the testing apparatus a standard ball is used which, before using, is compared by the chief inspector with Johansson blocks.

Figure 4 shows the action of testing a standard ball. The minimeter used for this purpose will indicate ac-

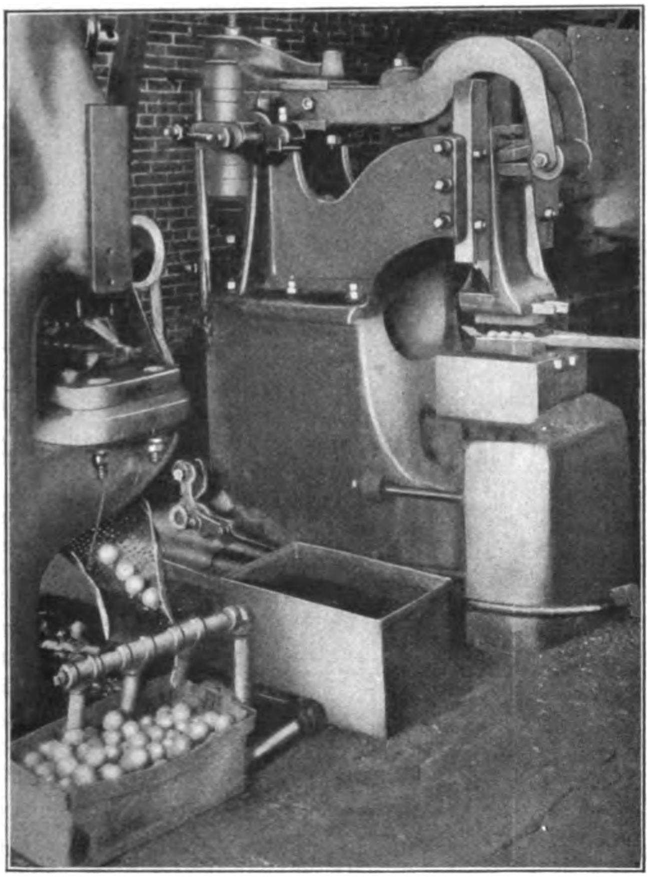


FIG. 6—FORGING STEEL BALLS. ALSO SHOWING HOT PRESSED BALLS COMING FROM THE PRESS AND COOLING DEVICE

curately to a 40th of one thousandth, that is to say, it compares to that limit though it does not measure. Johansson blocks are piled up to the correct size and the minimeter is set so that the hand points to 0. A magnifying glass in front of the dial of the minimeter makes it possible to make this setting very accurate. The standard ball is compared with this minimeter setting and if the result is satisfactory the ball is used for the setting of the straight edges of the inclined plane.

In Fig. 5 the inclined plane is once more shown in diagram. This time it is arranged as the Atlas Company arranges the device, that is, with only one partition. The straight edges are set so that the standard ball will drop to the right of the partition. The setting is made so accurate that a ball of the correct size will fall and strike the partition as is shown in the illus-

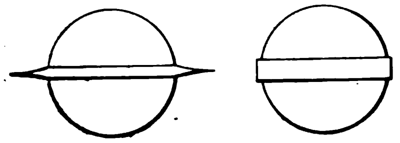


FIG. 7—DIAGRAM SHOWING NATURE OF FIN PRODUCED BY COLD PRESSING. FIG. 8—DIAGRAM SHOWING HOW FIN IS CHANGED BY ROLLING BETWEEN HARDENED PLATES

tration. The vertical center line of the ball is slightly to the right of the partition.

Should a ball be ever so little too small it will drop to the left of the partition. In either case, its speed before dropping is very small. With this arrangement of the straight edges it is unimportant whether these straight edges are really straight or not so long as there is only one point at which the standard ball will drop.

As a matter of fact, the balls used for setting the machine are not the standard size but the maximum and minimum allowable sizes. As Fig. 5 is arranged, the minimum size ball has been used so that all balls dropping to the right of the partition are above the minimum whereas all balls dropping to the left would be below the minimum and should be rejected.

After the balls have been gaged in this manner they are once more run over the inclined plane, this time set for maximum so that all balls dropping to the left of the partition are below the maximum while those dropping to the right are above the maximum and are therefore rejected. At the end of the two inspections we have balls which are above the minimum and below the maximum and therefore correct. In reality, two gaging machines are set up at the same time, one for "go" and the other for "no-go." As we have seen how inspection takes care of size and quality we will show now how this quality is obtained.

Sizes of Balls Made

The balls made by the Atlas Company range regularly from ⅛ in. to 2½ in. Larger balls are also made but not as a regular product. Such a wide range of sizes requires, of course, different methods of manufacture. It is rather remarkable, considering the wide range of sizes that in the main the same methods are used, there being certain differences only in the first operations.

The smaller balls up to $\frac{9}{16}$ in. are cold pressed. Larger ones up to 1½ in. are hot pressed and still larger sizes are forged. A number of balls are forged at the same time under the Bradley hammer. This operation is shown in Fig. 6 and needs no further explanation. In the foreground a press for hot pressing is shown and 4 balls are rolling along a sheet toward the box in which they are received. It will be noticed that a pipe is arranged over this box. This is a compressed air pipe which assists in cooling the balls.

The cold pressing of the smaller balls is done on a rivet machine and offers no difficulties except that it is necessary to cut the slug closely to size so as to avoid

excessive fin. Such a fin extends around the ball as a thin sheet, shown in a somewhat exaggerated form in Fig. 7. Though the amount of metal in the fin is very small its shape would cause trouble when these balls are placed in the grinding machine. For this reason they are sent through a machine where they are rolled between hardened plates which changes the fin over to a form as indicated in Fig. 8. Though there is almost as much metal in this fin as there was before, it no longer causes trouble when grinding.

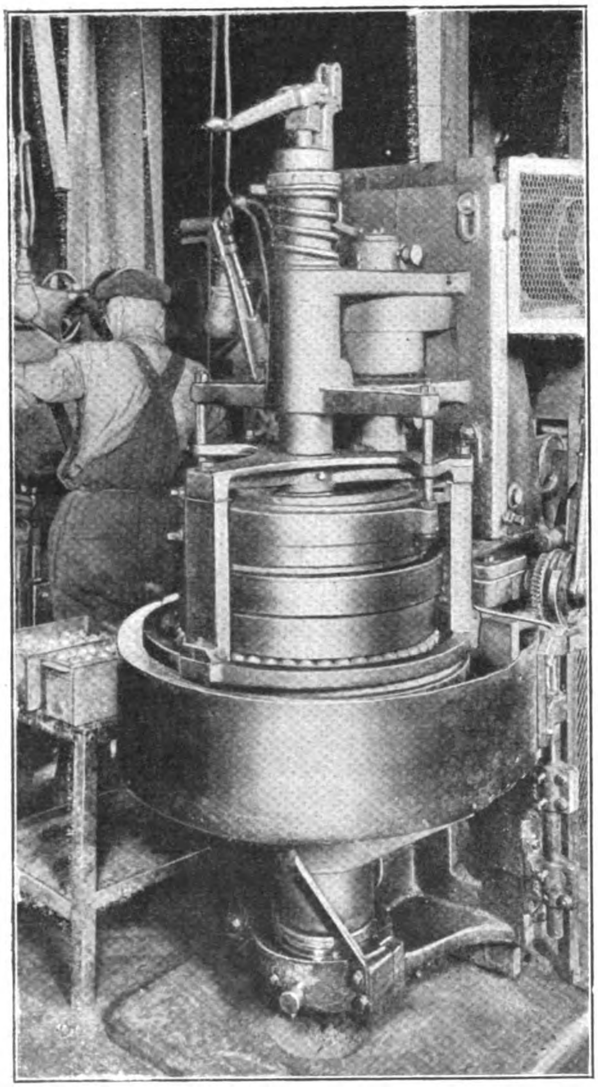


FIG. 9—ROUGH GRINDING MACHINE (VERTICAL)

Such fins are not produced by hot pressing or forging. When hot pressing, the heated slug drops automatically from the furnace on to a plate where it is gripped by a pair of fingers and brought in position, after which the fingers retreat just before the upper die comes down. The fin caused by this operation is very small and does not need to be removed. Neither is there a fin when the balls are forged. In that case there is merely a small projection left at the point where the balls are separated. Figure 6 shows how a number of balls are forged at the same time.

The material used for the smaller balls, that is, for those which are cold pressed, is cold drawn wire. The length of the slug is about 1½ times the diameter of the wire. From this the correct diameter for each size ball can be easily calculated. The wire may be 0.002 in. over-size or under-size. The hot pressed balls are made of cold drawn rods which are allowed the same variation from standard, while the material for the forged balls is hot rolled bars with 0.005 in. permissible variation below and 0.009 in. above standard size.

The operations vary to a certain extent according to whether the balls are made of cold pressed or hot pressed and forged material. In the latter case the following list of operations obtains:

First operation — Annealing
Second operation — Rough grinding
Third operation — Hardening
Fourth operation — Rough grinding
Fifth operation — Oil lapping
Sixth operation — Hoffman grinding
Seventh operation — Polishing
Eighth operation — Finish polishing, after

which the operations are measuring and inspection as heretofore described.

In the case of small balls, the operations are as follows:

First operation — Rough grinding.
Second operation — Annealing
Third operation — Hoffman grinding in the soft state
Fourth operation — Hardening
Fifth operation — Hoffman grinding—hard
Sixth and Seventh — Rough and fiinish polishing

Allowance for Finish

The amount allowed for finish on the larger balls is 0.050 in. The rough grinding brings them down to about 0.014 in. over-size. The second rough grinding, after hardening, reduces that to 0.008 in. over-size, the oil lapping to 0.0025 in. and the Hoffman machine to 0.0002 in. over-size so that the rough and finish polishing removes $\frac{2}{10}$ of a thousandth regardless of the size of the ball.

In case of the smaller balls the amount allowed for finish is 0.020 in. The first rough grinding when soft, reduces this allowance to 0.012 in. The second grinding, still soft and which is done on the Hoffman machine, reduces this to 0.005 in. over-size. The final grinding, after hardening, also on the Hoffman machine, brings the balls down to 0.0002 in. over-size just as with the larger balls.

Figure 9 shows a vertical rough grinding machine which consists of an upper and a lower spindle, both rotating and *not* in line with each other. The upper spindle carries a disk with a number of concentric V-grooves in which the balls are located. The lower spindle carries a grinding wheel. The eccentricity is such that every part of the rim of the cup-shaped grinding wheel comes in action so that the balls cannot have a tendency to produce grooves in the wheel. The grinding is done dry as it was found that wet grinding was not satisfactory. It will be noticed that the upper spindle is forced down. The amount of pressure, however, is not very great, being about 70 lb. to 100 lb. in all. The rotation of the two members causes the balls to travel in the grooves and the eccentricity of the grinding wheel in relation to the upper member causes the balls also to turn in the direction of the radius of the upper member so that every point of the ball is at some time exposed to the action of the grinding wheel.

When these balls come out of the machine they show a large number of small facets with parallel grinding scratches.

(To be concluded next week.)

Details of Diamond Boring Tools

Recommended Sizes of Boring Bar—Angle for Setting of Tools—Methods of Sharpening—Kind of Diamonds and How They Are Inserted in Tools

BY G. T. LINTING

THE SUCCESS of any diamond boring tool depends quite largely on whether the boring bar which carries the tool is as close a fit in its guide bushings as possible. The boring bars should be as large in diameter as possible, and should be provided are drilled and tapped for holding the tools firmly in place, as well as for adjustment. The tools are set at an angle other than a right angle to the axis of the boring bar, so that the tools can be measured with a micrometer over the edge of the tool and the bar.

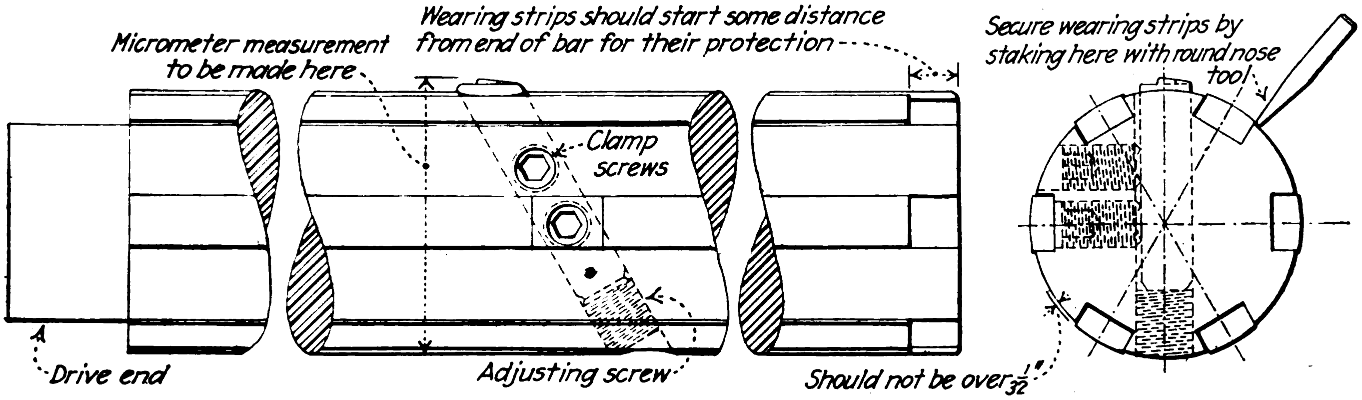


FIG. 1—BORING BAR WITH DIAMOND AND WEARING STRIPS IN PLACE

with the hardened wearing strips shown in Fig. 1. These strips fit hardened steel bushings in the boring fixture as tightly as possible, and still turn without galling the bar or bushings. The bar itself is left soft.

These hard wear strips in the bar have a certain purpose. After the strips have been worn undersize so that they do not fit the bushings, the bar can be restored by either inserting new strips or shimming up the original strips and then regrinding the bar to fit the bushings. Should these strips by chance become galled in the bushings the bar can be restored to its original size by the method just described.

The method of inserting the wear strips in the bar is as follows: Four or six grooves, depending on the size of the bar, are milled the entire length of the bar to within some few inches on the driving end. The strips may be from $\frac{1}{4}$ to $\frac{1}{2}$ in. thick and from $\frac{1}{2}$ to 1 in. wide and any length that can be conveniently carbonized and hardened. Any stock that will carbonize and harden may be used. The strips are hardened before they are forced into the bar, the edges having been previously milled to a light drive fit in the slots in the boring bar. The strips are forced into the slots and then staked in tight along the sides, as shown in Fig. 1. Screws are not needed to hold them in place. After the strips have been forced into the bar they are then ground so that they will fit the bushing in the jig.

The holes for carrying the diamond and steel tools

This setting is also employed in order that a longer tool many be used and may be more firmly held in the bar. The particular angle at which the tool is set is of no importance so long as its setting can be measured over the bar, as the left view in Fig. 1 indicates.

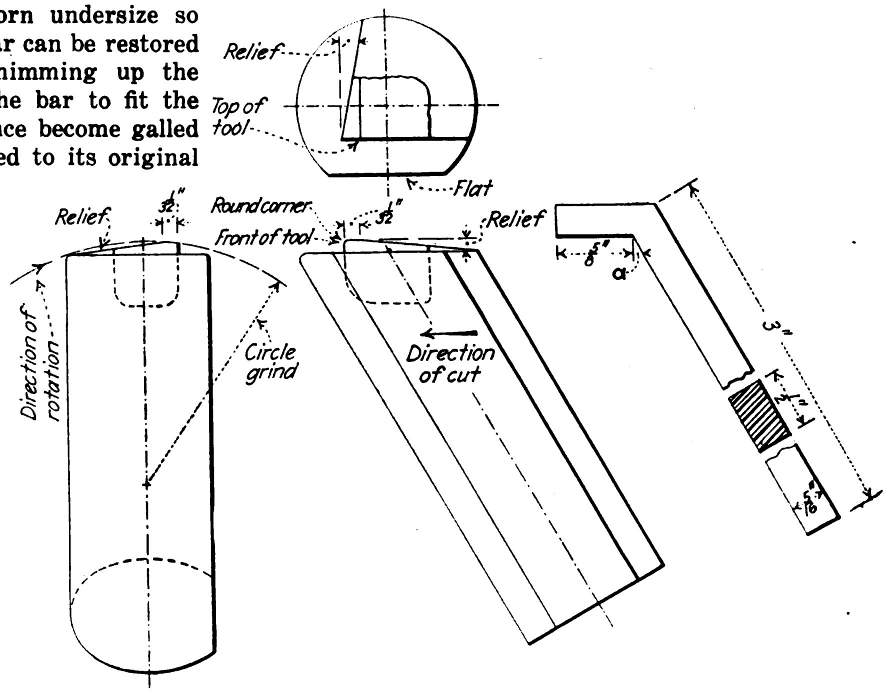


FIG. 2—DETAILS OF SHANK WITH DIAMOND FASTENED TO IT AND GAGE FOR CHECKING RELIEF AND ANGLE

The diamonds used for boring tools should be the finest quality of Brazilian Carbonado. Although they are the kind used for rock drills, they should be selected for a fineness of texture and for freedom from cracks or irregularities in formation. The diamond is first roughly lapped to a cutting edge then fastened in the

This article supplements "Using Diamond Tools in Motor Building" by the same author, published on page 437 of *American Machinist*. The additional data have been furnished at the request of the editors of *American Machinist*.

bottom of a metal mold with brass wire. The mold is then filled with a molten metal, an alloy which has a melting point of about 2,000 deg. Fahrenheit. Fig. 2 gives the details of the shank and the diamond attached to it, as well as the details of a gage for checking the relief and angle.

After cooling, the shank in which the diamond is now firmly embedded is removed from the mold turned to the size desired which is usually from 3/8 to 3/4 in. in diameter and from 1 to 3 in. long. It is put in a dummy bar which has a hole drilled in it at the same angle as the boring bar and of a size to fit the shank. The diamond is then circle ground to a radius shorter than the radius of the hole which it is to bore, and is backed off the same as any fluted cutter leaving about a 1/32-in. land. The diamond is then relieved at the heel leaving about a 1/32-in. land parallel with the axis of the bar. A small steel wheel charged with diamond dust is used for all the grinding operations.

The face of the diamond is then ground perpendicular to the axis of the bar leaving the diamond projecting about 1/32 in. out of the end of the shank. The front of the diamond is ground the same as the face and is relieved slightly toward the back. The sharp corner is slightly rounded so that it will not break off.

The method that should be followed in grinding or sharpening these tools is precisely the same as that employed in sharpening a steel single point boring bar tool except that care must be used, of course, to grind away as little of the stone as is possible. Care should be taken in setting the diamond tool in the bar to see that the cutting edge is parallel to the axis of the bar. To prevent injury to the diamond, the machine operator should be instructed to handle the tools with the same care he uses for any fine tool.

Factors of a Foreman's Success

BY ROBERT GRIMSHAW

The factors making up a foreman's success might be laid down as the possession of those qualities that make almost any leader successful: Knowledge of his own qualifications, of his defects, of the abilities and limitations of those with whom he comes in contact, of the activity in question, and of the ability to impart his knowledge and make himself obeyed.

But some things might be pointed out as the potent factors in a foreman's success. They may be worth cultivating if nature has not been generous in this connection at birth, and if opportunity and environment have failed to make amends for those qualities which nature has neglected.

Perhaps the first factor that might be particularly singled out as desirable, is openmindedness. This is the willingness to admit that others do, can, or have an inherent right to know something; or can even be on the right side of a disputed question.

On broad general principles, the foreman is assumed to know more, even in petty details, than those under him. But if he cannot show this to the satisfaction of others he will be set down as wrong. Once his fallibility and ignorance are shown to exist and to be backed by his tacit or other declaration of infallibility, his influence for good, his strenuous seeking for progress in the work, his most earnest efforts for the betterment of his operatives' condition, are weakened, if not entirely destroyed.

Six Ways of Securing Co-operation and Interest from Your Men—Discussion

BY EDWARD O. PERRY

The article by E. O. Kuendig under the title given above on page 680 of *American Machinist* corresponds with the views and practice of the writer during long experience in the management of help.

I know of no condition in life where the Golden Rule is more applicable than in the relations between the employer and employee. Never ask a man to do anything that you would not willingly do yourself if you were placed in his position. Give them the benefit of every doubt, but remember that under good management there should be few doubts. Hard work and good pay, honestly earned, give greater satisfaction than any other policy I know of.

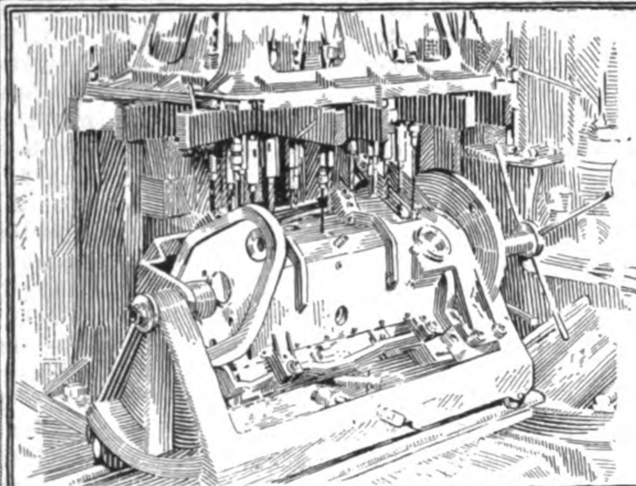
OPERATING ON STRAIGHT PIECE WORK WITH A HEART IN IT

I will cite one case among many that came under my supervision where the policies mentioned by Mr. Kuendig were carried out to the utmost. It was in a plant manufacturing heavy, portable railway equipment, and which in addition to office and engineering departments, consisted of machine, foundry, blacksmith, boiler, paint, pattern and minor departments. The greatest number of men employed at any one time during my administration was about 1,100. It was an old institution and had been in the hands of a receiver for several years, but through the generosity of some of the people of the city in which it was located, funds were furnished to place it in operation again.

After a preliminary investigation of the plant, I took a position with the company as general superintendent and proceeded to make radical changes.

Straight piece work, with a heart in it, was the first innovation. In its introduction I met with bitter opposition from the workmen, the cause of which I soon located in a radical group that had been driven out of a large plant then on strike in a neighboring city. With this knowledge, I soon got rid of the trouble through the elimination of that element. I made it my duty personally to urge the acceptance of piece work by every one opposed to it. In order to make a good start, I personally set the prices and hired the help, and in general remained in close touch with every one along the line. In less than three months we had the machine shop and foundry on piece work, and the well filled pay envelopes of the men in those two departments were sufficient influence to bring the remaining departments into line without further effort. Before that time I had selected from the shop a cleancut, bright looking machinist for the position of chief inspector and rate setter, and I never regretted the selection, as he proved one of the most loyal and honorable men that ever worked for me.

It would be encroaching too much on your valuable space to describe all that was done to insure harmonious relations between the workmen and the company. There were secured for the former higher wages than they had ever had, and for the latter more profit than they had expected. More than that, the employers had the right to complete control of their business in all its details, without question from anyone, either inside or outside of their plant. All this was accomplished in the most satisfactory manner and perfect confidence established between the workmen and the company.



Tool Engineering

By
Albert A. Dowd and Frank W. Curtis
President and Chief Engineer
Dowd Engineering Company, New York City

Design of Piercing Dies Begun—Principles and Important Points of Piercing Dies—Plain and Button Dies—Punches, Dies and Strippers

PIERCING dies are often used for producing holes in work which has previously been blanked or formed, and also occasionally for making holes in flat stock from the strip. We have already discussed the use of piercing dies when the operation consists of blanking and piercing in progressive dies, and several points which have been mentioned in the preceding articles are also applicable in the design and construction of piercing dies.

Dies of this kind may be roughly divided into several types, although the dividing line is not sharply defined and the classification cannot be made very distinctly. Roughly speaking, however, the grouping is as follows:

Plain piercing dies, which are so designed that they handle plain blanks of various shapes or pierce the holes in sheet stock according to the requirements of the work.

Button dies, in which the dies are made in separate units and inserted in their proper locations in the die shoe. This form is economical, so that in manufacture and upkeep it is often used when the holes are a considerable distance apart. Button dies may be standardized to advantage when work is of such a nature as to require a number of them. Blanks of standard outside diameter can be made up according to the size of the holes required, after which it is only necessary to bore and lap the hole and fit the button to the die shoe.

Multiple piercing or gang dies are used when a number of holes are to be pierced close together in a given piece of work. Both dies and punches are of somewhat different construction than those previously described. The details of design and various points of importance will be mentioned specifically later in this article.

Perforating dies are often required in ornamental brass and silver work and for such parts as armature disks, slotted radial plates and both plain and cylindrical work requiring perforations of various shapes and sizes.

The construction of piercing dies is comparatively simple, yet when a number of holes are to be pierced in an irregular piece of work, the design must be carefully made and a construction used of the most approved form if best results are to be obtained. The designer who applies his knowledge of fundamental principles to the construction of dies and who studies not only the design but its application in actual practice, considering carefully at the same time the upkeep and preservation of accuracy, will discover new points of interest continually and find fresh food for thought in the solution of each problem presented. A number of important points regarding the design of piercing dies are given herewith; others will be mentioned in detail later.

(1) Laying out the work. The importance of this matter has been emphasized in previous articles several times and in the design of piercing dies also it requires fully as much consideration as those previously mentioned. A decision must be reached as to the best type of die for the work in hand and in what manner it can be handled most advantageously.

(2) Thickness of stock. It is essential that the thickness of the stock should be in correct proportion to the amount of material around the holes which are to be pierced. If the allowance is not sufficient the work cannot be pierced so as to obtain good results. Hence, this point should be considered at an early stage in the design. The diameter of the hole is also important, as it is not practical to punch a hole smaller in diameter than the thickness of the stock. When holes of smaller size than this are required, a drilling operation is usually necessary.

(3) Location of work. A great deal depends upon the shape of the work and whether the piercing die is to operate on strip stock or on separate blanks previously punched. The location depends to some extent on the relation which pierced holes must bear to other holes, slots or surfaces. Therefore the method of location must take these matters into consideration and must at the same time provide for the possibility of slight variations in the blanks. Obviously this matter depends very largely on the general shape of the work and its requirements. Particular attention must be paid to work requiring a high degree of accuracy.

(4) Guide for punches. Piercing punches are often small in size and therefore easily broken. Attention must be paid to proper support in order to avoid such a contingency. Usually the stripper plate acts as both

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guide and support, having a function somewhat similar to that of a bushing in a drill jig. In point of fact, bushings are often used in the stripper plate to guide and support the piercing punches and prevent breakage. The stripper plate therefore must be located carefully and so arranged that it can be used as an accurate

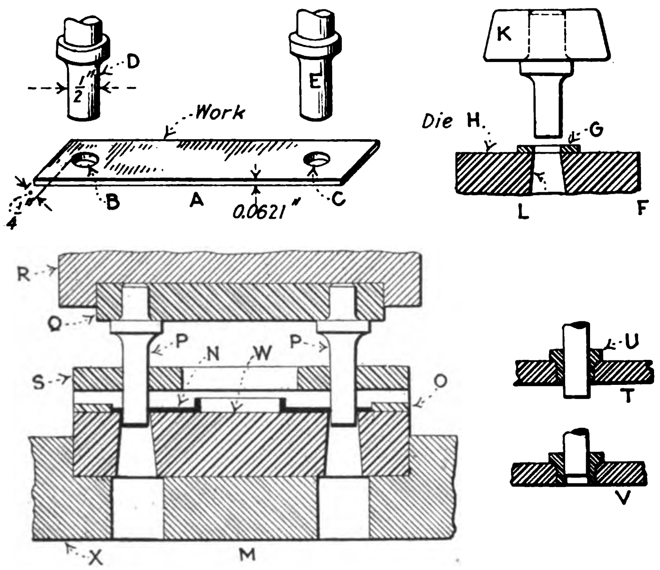


FIG. 482—PRINCIPLE OF PIERCING DIES

location and suport for the punches. Several examples illustrating this point are given in this article.

(5) General points in design. Consider carefully the operation to be performed as a whole. Look at it in a broad-minded way and with a large amount of common sense. Take up each point in design carefully and analyze the operation to make sure that suitable provision has been made for all contingencies. Consider the operator from the standpoints of both safety and convenience. Finally, design the dies so that they will produce the work in the shortest possible time, well within the required limits of accuracy and with suitable provision for upkeep when worn or broken through use, misuse or neglect.

Principles Involved in Piercing Dies

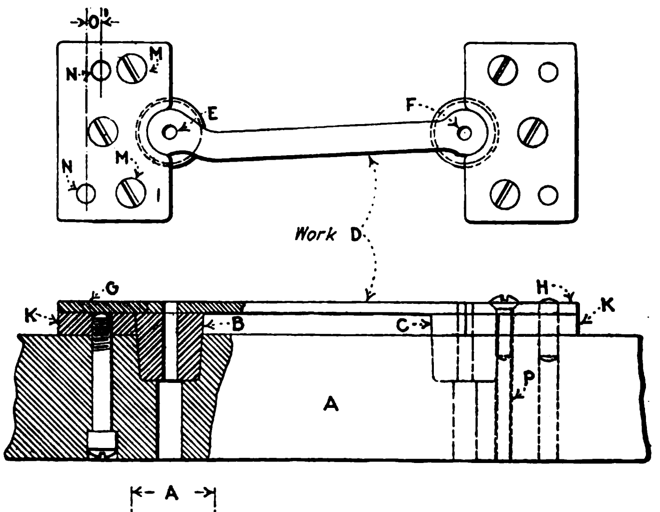
In piercing metal such as steel it is customary to allow an amount of stock around the hole to be pierced equal to or greater than ½ the diameter of the hole. It is possible to allow less stock than this in exceptional cases but it is not advisable, as there is always the possibility that the blank will be distorted when piercing so that the resulting product will be unsatisfactory. When a blank is to be produced having an amount of stock around the hole which is less than half the diameter of the hole, it is advisable to make a test by piercing a few pieces in a simple die rather than to design and construct one of more complicated form which may, under test, prove unsatisfactory. The experiment will demonstrate whether the stock will stand the strain of the piercing, and if found impractical to use a piercing die it may be better to produce the hole by means of a drilling operation.

Another important consideration in the design of piercing dies is to make sure that a hole of smaller diameter than the thickness of the stock is not required. In such cases the punch is subjected to an excessive strain due to the small diameter, so that it will not withstand the pressure and thus causes a great amount of trouble by breakage. Under certain conditions modifications may be found possible, but only after a series of tests has determined the advisability of it.

The principles involved in piercing dies are illustrated in Fig. 482. In the example shown at *A* the work is to be pierced at *B* and *C*. The blank is 6 in. long, 1 in. wide and 0.062 in. thick. The diameter of the holes to be punched is ½ in. and the distance between the end of the work and the holes is ¼ in. The punches for this piece are shown at *D* and *E;* and at *F* is shown a section of the die in which it is apparent that the work *G* rests on the die *H*, and that the punch *K* descends until it has passed through the work and entered the hole *L* in the die. When work of this kind is pierced, a slug is produced which passes through the die and bolster of the press and is generally caught in a box placed in a suitable position. As in blanking dies, the work must be carefully located when piercing is to be done, and the method of location selected is naturally governed by the shape of the piece which is to be pierced.

In the diagram at *M* a sectional view of a piercing die is shown which is used for piercing eight holes in the work *N*. This piece is round in shape, and it is located by "nesting" it in the locating ring *O*. The punches shown at *P* are fastened to the punch plate *Q* which is screwed to the punch holder *R*. Attention is called to the manner in which the punches are guided by the stripper *S*. In the diagram the punches are shown after they have passed through the work and are ready to be withdrawn.

In order to prevent the punches from binding or cramping in the work, it is necessary to use a stripper as indicated. It is apparent that when the punches are withdrawn the metal comes up with them until it strikes the stripper, which sheds the work so that it can be



A	B	C	D	E
½	¾	¼	¼	1°
¾	¾	5/16	¼	1°
1	¾	⅜	¼	1°

FIG. 483—APPLICATIONS OF BUTTON DIES

taken out of the die and replaced by a new piece. When the work which is to be punched is made of tough stock or when a hole of small diameter is being pierced, the stripper is of great assistance in stiffening the punch and guiding it to a correct location. In many instances it is found necessary to fit the stripper with bushings

in order to support it rigidly and at the same time provide accurate location. In the example *T* a stripper plate is shown having a bushing *U* mounted in it.

The diagram at *V* shows the punch in its furthest upward position, and the designer may note that the punch is not entirely withdrawn from the stripper or bushing when the punch-holder is raised. Referring to the section of the die shown at *W* to hold the work *N*,

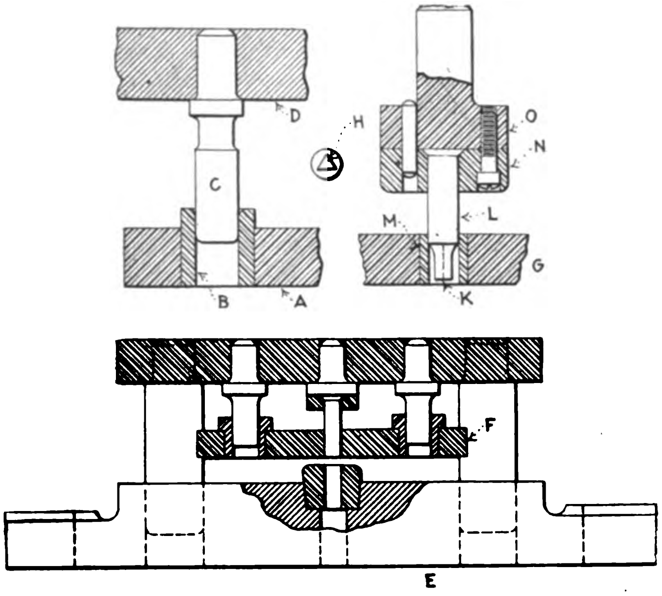


FIG. 484—STRIPPERS, STRIPPER GUIDE PINS AND PUNCH FOR HOLE NOT ROUND

it will be noted that the die is of solid construction mounted in a die shoe *X*. There is a considerable amount of steel used in this die which is unnecessary and the construction would be simplified considerably if button dies were used for this piece.

Button Dies

An application of button dies to a piece of work where the holes are a considerable distance apart is shown in Fig. 483. It also illustrates how dies of this sort may be standardized to some extent, thus simplifying and cheapening the manufacture. Primarily, a button die may be considered as one in which one or more cylindrical pieces of steel are substantially held and located in a die-shoe. Each button or disk has a hole through it for the punch to pass through after the work has been pierced.

At *A* the die shown is a cast-iron shoe having two button dies *B* and *C* mounted in it as indicated. The work *D* which is to be pierced at *E* and *F* is nested or located by means of the two plates *G* and *H*. The button dies project somewhat above the face of the die-shoe, and it is therefore necessary to make the locating plates of a corresponding height. The reason for setting the dies so that they project above the face of the die-shoe is to permit them to be ground a number of times when they become dull, thus giving long life to the dies. The locating plates, being built up to a height such that they conform to the height of the die, can be very easily adjusted after each grinding by taking off a corresponding amount from the filler plates. These latter plates are indicated at *K*, and both location plates and fillers are held by screws *M* and dowel pins *N*.

The dowel pins are staggered as shown at *O* in order that replacements of the parts may be made so that they will always come in the same position. By staggering the holes, errors in replacement of plates will be evident when reassembling after grinding, and as the plates can be put back in the original position only, incorrect assembling is avoided. When tapping the hole shown at *P*, care should be taken that it is tapped deep enough so that the screw will not bottom after the die has been replaced after grinding.

We have previously taken up the standardization of punch holders, punches and dies for blanking purposes. As button dies are used frequently, we have given in the lower part of the illustration just considered a table which shows the dimensions of button dies used for piercing various sizes of holes. In all cases the dies project ¼ in. above the face of the die-shoe and the angle on the sides is one degree. It is not necessary to fasten the dies into the shoe, because the slight angle of taper makes them fit so snugly that screws or dowels are unnecessary.

Strippers for Piercing Dies

Strippers for piercing dies are more important than those used for other purposes, as it is often necessary to support the punches by means of the strippers, particularly when punches are small and delicate. When button dies are used for piercing holes the stripper is often mounted on the punch holder. The method shown in Fig. 484 illustrates a construction somewhat different from that used in blanking dies. Here the stripper *A* is provided with a bushing *B* and a guide pin *C*, the latter being held in the punch holder *D* as shown. When the stripper is mounted in this way an accurate and

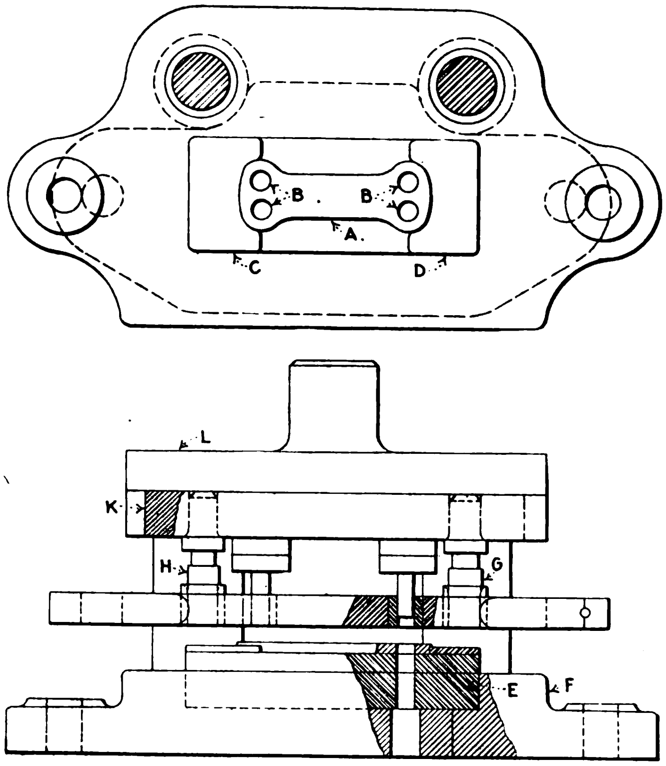


FIG. 485—DIE HAVING CAM STRIPPER

rigid support is obtained, which is essential for accurate piercing operations.

At *E* is shown the general arrangement when mounting a stripper of this sort. Stripper *F* contains two bushings and two guide pins which fit the bushings. The springs used in this stripper plate are not shown, as the diagram is only intended to illustrate the method in which the the guide pins are used. A button die is

shown in position, together with the punch which is used for the piercing operation.

It is frequently necessary to provide a bushing for the punch as previously mentioned, particularly when a small diameter or irregular shape is used. The punch in the example shown at *G* is of triangular shape, as indicated at *H*, and it has been shaped down as shown at *K* while the body *L* is round so that it fits the bushing *M*. The punch in this instance is of the wire type, and it is held in position by the cap end and the thrust is taken by the punch holder *O*. A construction of this kind is very frequently used in piercing dies, and it will be found satisfactory in many cases.

Cam Stripper

A cam stripper is often used in piercing operations, and its use is in connection with presses of special design. The operation is entirely automatic and is controlled by the ram of the press. This type of stripper comes down on the work and assists in holding it down and straightening it out if there should be a wrinkle in it, always assuming that the stock is not too thick. This stripper also keeps the work straight and in position so that it does not shift as the punches enter into it and pass through it. It remains in position holding the work until the punches have been withdrawn, after which it moves upward with the ram of the press. An arrangement of this kind has the advantage of preventing the blow against the lower side of the stripper plate, which with stationary strippers occurs on the return stroke of the slide, because the play necessary between the die and the face of the stripper permits the punched bar or sheet to draw up against the plate before stripping.

In Fig. 485 is illustrated a die in which a cam stripper is employed. The work *A* has four holes to be pierced in it in the positions indicated at *B*. The work locates in the set edges *C* and *D* and also on the die *E*. On account of the position of the holes, which are close to each other, a button type of die is not used in this case. The die is mounted in the usual manner in a shoe *F*. The stripper is provided with two guide pins at *G* and *H*, these being mounted in the punch *K* held in the punch holder *L*. The piercing punches in this case are of the wire type similar to those described in the preceding illustration and the general construction of the dies is of the sub-press or pillar type.

What About Machine Tool Prices? —Discussion

By F. P. Terry
Belfast. Ireland

The editorial under the above title on page 311, Vol. 57, of the *American Machinist* introduces a very interesting subject at the present time. Without doubt many intending purchasers are still "holding off" for further reductions, though there are many exceptions. The editorial mentions "That the machine tool builder has never charged enough for the product of his brain and skill," wich is undoubtedly true in substance and in fact. Why this is so it is not difficult to understand, but we cannot blame the builder, and, if the time has now arrived for a better state of affairs, he is fully entitled to the extra forthcoming. No doubt, in the past, machine tools have been the means of building up huge fortunes for the purchasers. They have been purchased on the basis of what they cost to build, after which they have been put to work producing articles that have been sold on the basis of what they will save, bringing profits to the manufacturer in many cases far beyond the wildest dreams of the machine tool builder.

If we look back a little into the history of machine tool building, we find that engineering firms began by building their own tools and in some cases supplying a few other firms with certain specialties at a good price on the take it or leave it principle, by which method they disposed of all their production, and it was this state of affairs that started firms to specializing in machine tools. The outlook was rosy and a few firms made money, but they soon found that they were up against a most unhealthy competition and unless prices were cut to the bone users of machine tools made them themselves, and many cases could be given where this was not only done but that the machine tool builder's own tool was used not only to provide a design but to produce its kind.

Some thirty years ago I was employed by a large firm engaged in producing several kinds of engines and hydraulic machinery. They had several good radial drilling machines without any maker's name thereon, and on enquiring into this, I was told that the old man some years before had purchased a radial drilling machine from a well-known machine tool firm and after getting a quotation for half a dozen was so staggered at the price that he decided to go into the business. The machine purchased was stripped down, drawings and patterns made, and from that time on they just made others as required. That he was stealing the machine tool builder's brain and skill he never gave a thought, although he was most particular about his own products.

A Well Known Occurrence

Hundreds of cases of this sort could, no doubt, be given by machine tool builders; many could be given by myself, but I never heard of a firm building its own supplies of other kinds, such as typewriters, time clocks, etc. Consequently it was this state of affairs that compelled the manufacturer of a turret lathe to make its cost as near as possible to the ordinary lathe, regardless of the saving it would effect, and so on throughout the line.

Only a short time ago I was in charge of a machine shop wherein to get machine tools always brought on a long debate on the enormous price, yet this same firm never hesitated a moment over foundry equipment, "owing to the labor saving effected," and a rough contraption of a few castings and bright drawn bars that would shake sand in or out of flasks would be ordered off hand regardless of what it cost to make. "It will soon save its cost" was the principle worked upon, and quite right too, but why it is not recognized more with machine tools is difficult to understand. Machine tools frequently save their cost many times over in what they produce, for which cash is drawn, and some manufacturers see and realize this, but it is regrettable more do not look closer into the matter. If they did, we would not see so many shops full of relics that have passed their day and generation, and the machine tool trade would be as busy as it deserves to be. In years gone by a few of these relics were very useful for starting the boys, but today, with lathes and tools simplified for this purpose, there is no excuse for their use, or the space they occupy, and to put a boy to work on relics only tends to injure his chance of success in life.

What's Wrong with the Railroad Shops?—IV

Suggestions Regarding Interchange of Information and Standardization of Parts and Methods—Remarkable Cost Keeping Systems

THOUGH A NUMBER of things were criticised in the previous articles, many more faulty conditions were observed and might have been mentioned, except for the fact that the world does not derive benefit from criticism unless it be constructive. On the other hand no improvement can be suggested unless it is first pointed out where improvement is needed.

This need for improvement may be evident to the outsider, but may not be appreciated by the man who has been working for many years under the criticised conditions. At the same time it must be remembered that the casual visitor may not have the proper perspective; that he sees details only and may condemn the whole because some of the operations are not so good as they might be. Straws will show in which direction the wind blows but, after all, a single straw does not tell us much; it may have dropped from the hay wagon and there may be no wind at all. However, when the place is full of straws and they all point in the same direction, we may safely assume that there is a wind and that its direction is the direction of the straws.

WHY HAS there been no successful attempt to standardize parts, equipment or methods in the railroad repair shops of the country? The element of competition is absent and the work in all the shops is much the same, yet hardly any two shops do the same job in the same way. The cost keeping systems are bad, but no worse than many that may be found in other shops. We are not concerned with the other shops, however, nor with excuses for existing faults. Neither are we trying to blame anyone for any particular thing nor for the whole situation. Our sole purpose is to point out the more obvious difficulties and to suggest, in so far as we are able, remedies that may be applied without adding appreciably to the expense of the railroads and without running afoul of the regulatory bodies that are undoubtedly with us to stay.

In the case of the railroad shops, there were so many straws that we were confronted with what the Frenchman calls "L' Embarras du choix." It was difficult to choose from the many things we saw those cases which could be handled in a few short articles in such a manner that both the trouble and remedy would be apparent to the reader.

Let us take the matter of the driving wheel lathe and see what improvements a few observations may lead to.

In one shop a hard tool was found in the machine and in another a soft one. These tools were not made of the same kind of steel, yet both had to do the same kind of work, and therefore, might have been identical. For aught we know there may be many different kinds of steel used for this purpose and they may be heat-treated in many different ways. It is almost certain that one or two of the different kinds stand out above the others, and as railroad shops are not competing, there is no reason why all the shops should not use the particular kinds of steel and the particular ways of heat-treating that have been found to give the best results. All that would be needed then is a system of intercourse between the shops, not only of one but of all railroads.

Just imagine a society of master mechanics and superintendents with a paid secretary. All improvements in methods and operations are reported to the central secretary, who, at fixed intervals, informs every shop of the latest developments. If, for instance, a new kind of steel is tried out in one shop and is found superior to what was formerly used, this experience would be circulated. It would not be long before a sufficient number of tests had been made by a number of the shops to show beyond a doubt whether this steel is really superior for the purpose or not. It would probably cause communication of a number of other experiences either with the same steel or with other kinds. Some shops might have used this steel but with different results and might want to know why one shop could use it to advantage when another shop had to abandon its use. In short it would be very probable that there would be an exchange of experiences and ideas which would bring out not only the qualities of the steel under discussion but many other desirable and undesirable features and conditions about shops, equipment and methods. The same would apply to the heat-treatment, the shape, the angles, the dimensions, the supports for tools and whatnot.

This sort of thing cannot be done in the manufacturing industries because there is but seldom a sufficient sameness of material or product, and, even if there were, competition would not permit a manufacturer to make his improvements public and of benefit to his rival. However, such conditions do not prevail in the railroad shops. Here the product is the same—let us say driving wheels—same general shape, same material, same nature of cut, same type of machine used. Furthermore railroad shops are not competing so that there would be no business reason why any one shop should hold its methods hidden from others. We have a set of conditions here which permits of thorough co-operation and which might lead to beautiful results. Maybe there is an organization such as was suggested, but if so it has failed to work for the results are certainly absent.

Such an organization would do what is regularly done by the engineering department of an industrial company having a number of plants. Any improvement in tools or methods in one plant is handed over to all of them and the plant manager who failed to adopt a tested-out improvement would have to put up a very strong argument indeed to escape severe criticism.

This exchange of ideas is merely a method of standardizing. It is the collecting of data and applying them, work which is constantly going on in any well regulated shop. It costs some money but it pays; and, mark, each shop has to do this work for itself while railroad shops

are in a position to do it co-operatively, getting the full benefit for a small fraction of the cost. Not only that, but they would get greater benefit than any single shop would obtain because there are more experimenters and more observers.

It has long been recognized that standardization is one of the most important methods of reducing costs and expediting work, not only standardization of methods but of equipment and product, of tools and operations. Always excepting the exceptions there is very little evidence of standarization in railroad shops. Holes are rebored to any size that will make a clean job and the shaft or axle is fitted to this hole. There is no good reason why there should not be a few standard sizes to which such holes must be rebored. If this were done the male pieces could be made while the other pieces are being bored and they could be made in less time and by less skillful men. Furthermore, they could be kept in stock, thus avoiding all delay. This lack of standardization is not confined to the boring of holes. It is found everywhere, in sizes, in parts, in methods and in equipment.

More and Better Gages Needed

Standardization of parts and dimensions cannot be carried out without proper measuring instruments and gages. These are almost completely wanting. A micrometer is as rare in the railroad shop as in the average foundry, and gages are so conspicuous by their absence that the sight of an occasional one comes as a shock. At that, these few gages are generally of the crudest kind. One may find a rod to gage the bore of a tire and then see the workman try to balance a 12-in. scale at the end of that rod to make up for shortage.

There are many parts which could be kept in stock; there are others which, when not kept in stock, could be made to standardized dimensions and one naturally asks why this is not done.

The answer can only be guessed at. Gages cost money and such expense cannot be charged directly to repairs or maintenance or even to equipment, as is generally understood. They must come as part of a plan of action which may originate with the shop management but cannot be decided upon by them. Parties higher up must give authority to carry such a general plan into effect and they, as a rule, are not sufficiently familiar with shop operations to understand the importance and the ultimate economy which is certain to result from the purchase of fine instruments and gages which are capable of measuring to a much higher degree of accuracy than the rough work of repairing locomotives seems to demand. *Seems* to demand, we say, because, as a matter of fact, just as close limits are required for the proper fitting of locomotive parts as for typewriters and guns. An extra thousandth of an inch in the diameter of a driving axle makes a great deal of difference in the amount of pressure required to force it into the wheel. A few thousandths short in the bore of a tire increases the initial stress greatly.

Another possible reason why so few gages are used may lie in the fact that the rules do not permit the shop to make parts except on definite repair orders. Here again exceptions can be found but it can be stated as a general truth that most railroad shops live from hand to mouth. This minimizes the good effects which standardization might have.

Then there is perhaps that little vicious cycle of reasoning one always finds where conditions are not as they should be. The cycle may be something like this: We do not make more than one piece at a time because we have to fit them anyhow; and we fit them because there are not standard dimensions. We cannot have standard dimensions because we have no gages and what would be the use of gages if we make only one thing at a time and must fit it? Of course, such a complete cycle never passed through anyone's head but all of the elements may have at one time or another.

The thing to do is to break away from all existing conditions, from all reasons, excuses and alibis and start a new deal. Study out what would be the proper method of handling the work and get the best, quickest and most economical result; scheming as if there never had been a railroad shop. See where this ideal method differs from the one now employed and get ready to switch onto the new track. Not suddenly, not by tearing things up by the roots, but gradually, starting in with those things which will give the greatest results in the shortest time and with the least amount of expense.

Standardization is one of the things which can be introduced without a revolution, bloody or otherwise. It can be introduced piece-meal and does not require much equipment. A few micrometers and a little instruction will go a long way.

It does require, however, that the powers at the top should have confidence in the scheme and in the men who are to handle it, and it may be necessary for them to get somebody who is familiar with modern shop methods to help the shop manager over some of the rough places and point the way to him; for rough places there always are when one climbs from a rut onto the broad highway.

It may be argued that standardization cannot be carried out in some cases and would be of no benefit in others and this is undoubtedly true; but one should not condemn a scheme just because it is not one hundred per cent applicable. Such one hundred per cent perfection does not exist and should not be expected, yet the fact that a new method is not applicable to everything in the shop has often been the cause of its rejection when 90 per cent of the work might have benefited by it.

The lack of contact between the average railroad shop and manufacturing plants is vividly exemplified by the case mentioned in the first article where a number of geared head engine lathes were the tools intended for the manufacture of brass parts. Whether the shop was ill advised or whether the purchasing department refused to follow the recommendation of the shop we do not know. It was probably the former because the department was pointed out with a certain amount of pride. That such equipment would be used in any manufacturing plant for that same purpose is almost unthinkable.

Evils of Lump Purchasing

We venture to make a guess which probably is not far from the truth. We know of many cases where a list of equipment was issued to machinery makers and dealers who were invited to bid. In many such cases the entire list was covered by a single dealer who, not being able to furnish the exact equipment asked for, substituted such machinery as he was able to furnish. In doing so it was possible for him to reduce the price on some of the substitutes below what would have been a reasonable price for the machinery originally asked for. As a result that dealer would get the entire order, not because what he offered was superior to what anyone else had to offer, but because the total purchase

price was lower than could be secured by buying some machines from one and some from another dealer or maker. It might very well be that something similar happened in the case mentioned here. Whatever may be the case we consider it a glaring example of inefficiency and perhaps better illustrative of the lack of proper system, proper control, engineering knowledge and knowledge of manufacturing methods than anything else we observed.

One of the points mentioned in the last article was that a skilled blacksmith was making cold chisels and had a set of dies to assist him. Was he making them because the peculiar system of cost keeping made it appear as if the article could be manufactured more cheaply than it could be bought outside? It is of course very unreasonable to suppose that such is actually the case. A manufacturing plant which has all the tools and facilities for making an article in large quantities is certainly able to manufacture it at a very much lower cost than it can be made by hand and in smaller quantities. We say that the cost keeping system may possibly make it appear as if the article were cheaper than it actually is, and we have reason to think so because we found in another shop a system of computing the cost of axles made out of scrap which made them appear to cost less than half of the actual cost.

The amount of scrap used for an axle was not weighed but the finished forging was and it was figured that the amount of scrap originally used was equal to the weight of the finished forging. In order to make some money on the transaction the axles were forged from 16 to 24 in. longer than was required for the finished piece and the stub ends were cut off, that is 8 to 12 in. at each end. These ends were thrown into the scrap and the shop got credit for these pieces at scrap prices. If this shop had been a little bit more daring it might have made the axle forging come twice as long as required in which case the material would not have cost anything at all.

Other Costs Ignored

We hardly want to mention the fact that no loss of freight income was figured in. As a matter of fact this should have been done because if the scrap had been sold it would have been carried over this particular railroad and there would have been an income from this source. Nor was freight charged on scrap brought in from other shops or roundhouses on this road. The ingenious way of figuring the cost of this axle made it appear a very much cheaper article than anything that could be bought. Such bookkeeping, in any other concern, would soon put the company on the rocks but as the shop is only one of the minor elements of a railroad, the glaring faults lose their importance, or at least seem to do so.

That the railroad shop is handicapped in its methods, in its cost keeping and in many other items by the Governmental regulations is well known. We wish to point out here that we are not criticising any particular person or even the entire company. We are criticising conditions as we saw them.

There are many machines in a railroad repair shop which are not used all the time and some which are used only occasionally, but the greater part of the equipment is used quite regularly just as in the average manufacturing machine shop. Even if all of the machines were idle part of the time it would be good policy to have them clean, well adjusted, in good repair and up to date.

The workman cannot take pride in an old relic, particularly when it looks twice as old as it is with its battered T-slots, bent spindles, bare paintless spots, broken handles and the accumulation of dirt of which the lower layer was started 40 or more years ago. If the man takes no pride in his machine the chances are that he takes no pride in his work and that he won't even produce up to the capacity of his machine, small as it may be. It is a well understood principle in the average manufacturing plant that clean and neat surroundings will produce more and better work and keep the man better satisfied. Recognizing the fact that it is more difficult to keep a railroad repair shop in prime condition than most other machine shops because the work done there is repair work and means the dismantling of dirty machinery, realizing all this, we can yet see no reason why some of the railroad shops should be in the extremely dirty condition in which they are. That there is really no fundamental reason is proved by the fact that there are other railroad shops which are kept as reasonably clean as one might expect under the circumstances. However, this much can be said of practically all of them that the equipment is more battered and less taken care of than one finds in the average shop.

Preparation and Properties of Pure Iron Alloys

To protect life and property it is necessary that the architect and engineer know the kind of steel which should be specified for each use. To know what composition a steel should have to stand a certain amount of strain or meet the necessary requirements, the effect on the steel of each of its constituents must be known. The general effects of each of these constituents have long been commonly known, but technical difficulties have hindered really thorough studies of the specific and exact effects of each of the elements. Very pure iron is difficult to prepare, and it is even more difficult to add a controlled amount of some one constituent of steel to pure iron without some contamination.

In the belief that an accurate knowledge on this matter is desired by the engineering profession, and that such knowledge would prove beneficial to industry in general, the Bureau of Standards of the Department of Commerce has just issued Scientific Paper No. 453 dealing with the fundamental principles involved in the manufacture of steel products. The paper is entitled "Preparation and Properties of Pure Iron Alloys," and contains the results of a very careful investigation.

In this investigation iron of practically 100 per cent purity was prepared by an electrical method similar to the method of silver plating in which the metal is deposited from a solution by the passage of an electric current. The iron is plated out, leaving the impurities behind. This iron was then melted in a vacuum to exclude the effects of gases which would be taken up from the air if melted in contact with it. The heating was done electrically and the containing crucibles were made of chemically pure magnesium oxide.

Extensive series of alloys were made by remelting this iron in the same manner and adding carbon and manganese. Compositions were varied by small amounts so as to include the entire range of compositions found in ordinary steels. Specimens from these ingots were tested and results compared so as to bring out the effects of each element.

Table XI

Switzerland—Exports of Machinery for Working Metal, Wood, Stone, etc.

"Werkzeugmaschinen zur Bearbeitung von Metallen, Holz, Stein, etc."

Country	1909 Quantity q.n.	1909 Value Francs	1910 Quantity q.n.	1910 Value Francs	1911 Quantity q.n.	1911 Value Francs	1912 Quantity q.n.	1912 Value Francs	1913 Quantity q.n.	1913 Value Francs	1914 Quantity q.n.	1914 Value Francs	1915 Quantity q.n.	1915 Value Francs
Germany	1,498	339,931	1,517	517,422	2,736	818,576	3,814	1,141,730	3,754	831,193	3,091	711,532	13,841	2,840,614
Austria-Hungary	444	104,062	481	167,521	896	236,040	1,218	273,772	408	98,757	518	141,574	12,663	2,963,632
France	1,432	418,794	1,145	401,275	1,477	447,577	1,540	456,330	1,876	625,496	2,822	711,380	21,180	6,031,790
Italy	854	186,876	1,297	221,630	1,207	210,186	1,502	268,855	1,658	334,989	3,024	348,775	16,896	3,892,549
Belgium	233	37,934	421	66,525	243	63,835	90	25,651	234	80,009	321	37,270	2	445
Netherlands	55	16,118	132	27,974	100	22,478	185	57,872	288	53,428	223	26,139	59	11,825
Great Britain	184	55,082	153	58,289	204	84,939	191	80,050	209	72,993	104	55,799	533	292,838
Russia	194	33,310	191	38,442	321	59,125	357	83,369	328	89,987	419	91,720	148	86,202
Sweden	7	1,710	51	10,310	70	21,880	48	11,230	22	5,080	17	10,765	110	31,832
Norway	2	820	....	....	39	10,210	32	12,840	9	2,225	29	8,130	150	38,955
Denmark	116	20,580	2	400	....	....	13	3,342	....	....	1	230	5	1,840
Portugal	....	....	48	7,055	6	1,200	33	10,230	153	51,550	31	5,702	....	....
Spain	61	9,365	146	27,190	587	73,052	231	34,526	299	58,717	372	63,929	294	62,441
Greece	....	....	....	....	61	9,050	21	3,400	1	150	46	8,280	....	....
Bulgaria	26	4,000	....	....	21	3,188	19	3,224	30	4,400	....	....	....	....
Roumania	64	9,900	....	....	25	6,980	3	460	....	....	41	8,740	193	29,585
European Turkey	....	....	19	5,500	277	132,340	....	....	22	1,698	....	....	....	....
Serbia	....	....	12	13,000	....	....	1	460	....	....	30	4,920	....	....
Czecho-Slovakia	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Yugo-Slavia	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Egypt	18	1,800	1	460	3	2,150	....	....	30	7,180	101	26,080	....	....
Algeria and Tunis	....	....	7	1,525	1	284	18	1,700	50	7,985	69	14,000	33	5,400
South Africa	....	....	....	....	....	....	....	....	....	....	....	....	4	500
West Africa	....	....	....	....	....	....	....	....	....	....	....	....	....	....
East Africa	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Other Africa	....	....	....	....	....	....	....	....	....	....	2	300	....	....
Asiatic Turkey	....	....	26	3,930	2	540	....	....	66	9,000	4	850	....	....
British East Indies	57	11,030	39	5,950	66	10,070	2	370	1	130	29	4,050	....	....
French Indo-China	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Dutch E. Indies	1	200	4	780	3	591	....	....	....	....	....	....	23	3,405
China	1	1,900	....	....	....	....	....	....	....	....	....	....	....	....
Japan	....	....	....	....	21	3,625	29	11,887	52	14,400	....	....	41	11,855
Australia and New Zealand	48	6,940	33	8,306	81	10,395	4	2,500	....	....	1	674	3	1,500
Philippine Islands	....	....	....	....	....	....	113	17,400	....	....	....	....	14	2,800
Canada	37	7,500	26	23,950	4	1,000	7	3,050	....	....	....	....	....	....
United States of America	44	18,245	42	21,514	46	24,104	118	54,515	113	55,559	39	23,113	205	46,170
Mexico	....	....	....	....	....	....	3	1,500	4	1,700	1	300	....	....
Central America	....	....	....	....	....	....	19	6,550	....	....	....	....	....	....
Brazil	1	170	12	2,490	11	1,585	76	11,603	97	20,211	4	500	237	37,640
Colombia	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Argentina	15	3,500	72	7,400	12	4,075	245	42,375	64	9,486	....	....	....	....
Chile	....	....	53	7,625	32	5,500	1	332	17	2,340	42	7,220	....	....
Other Countries	....	....	26	3,880	15	2,850	17	4,117	....	....	35	8,290	....	....
Total	5,392	1,289,767	5,956	1,650,343	8,567	2,267,425	9,950	2,625,240	9,785	2,438,663	11,416	2,380,262	66,634	16,393,818

Table XI

Switzerland—Exports of Machinery for Working Metal, Wood, Stone, etc.—*Continued*

Country	1916 Quantity q.n.	1916 Value Francs	1917 Quantity q.n.	1917 Value Francs	1918 Quantity q.n.	1918 Value Francs	1919 Quantity q.n.	1919 Value Francs	1920 Quantity q.n.	1920 Value Francs	1921 Quantity q.n.	1921 Value Francs
Germany	9,762	3,669,446	51,444	20,847,428	3,303	1,680,747	1,429	1,254,226	830	751,685	572	406,000
Austria-Hungary	2,346	942,374	6,077	2,538,512	4,590	1,653,417	62	28,371	104	11,854	499	114,000
France	80,483	26,037,485	42,493	16,946,895	25,572	11,699,969	35,444	18,281,927	46,113	19,801,022	16,709	7,338,000
Italy	52,573	15,585,442	14,590	4,187,858	18,903	6,584,501	24,883	7,135,442	12,503	4,386,267	2,357	717,000
Belgium	.....	....	3	2,243	.....	....	2,699	1,096,476	7,402	2,408,493	1,704	620,000
Netherlands	126	24,358	289	62,285	2,613	988,136	3,145	1,198,810	1,765	931,871	563	401,000
Great Britain	2,763	1,013,415	433	342,878	937	679,906	1,422	1,289,317	2,740	2,953,296	1,338	902,000
Russia	1,006	502,399	52	38,963	.....	....	19	8,456	.....	....	.....	....
Sweden	17	9,755	48	26,125	18	12,350	46	26,296	389	201,251	25	15,000
Norway	199	21,505	40	18,001	5	4,365	51	45,177	52	65,406	65	65,000
Denmark	5	4,100	2	853	3	2,200	7	6,950	39	49,608	.....	....
Portugal	53	12,650	23	4,273	2	150	62	41,279	1,122	501,240	21	13,000
Spain	421	80,750	180	70,671	574	339,690	1,143	556,898	2,759	1,214,683	747	340,000
Greece	133	22,200	13	3,000	.....	....	67	31,148	253	80,269	104	38,000
Bulgaria	10	7,000	.....	....	.....	....	.....	....	.....	....	.....	....
Roumania	1,885	599,458	805	225,947	.....	....	139	38,262	5	5,086	.....	....
European Turkey	.....	....	.....	....	.....	....	.....	....	55	23,770	.....	....
Serbia	.....	....	.....	....	.....	....	58	21,229	.....	....	.....	....
Czecho-Slovakia	.....	....	.....	....	.....	....	.....	....	53	38,305	633	583,000
Yugo-Slavia	.....	....	.....	....	.....	....	.....	....	2	2,100	.....	....
Egypt	161	26,655	.....	....	8	7,900	19	15,430	288	115,780	62	25,000
Algeria and Tunis	39	14,900	1	220	142	48,690	174	67,905	32	12,871	.....	....
South Africa	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
West Africa	.....	....	.....	....	.....	....	.....	....	27	9,068	.....	....
East Africa	.....	....	.....	....	.....	....	.....	....	11	2,310	169	51,000
Other Africa	.....	....	.....	....	.....	....	9	8,990	.....	....	.....	....
Asiatic Turkey	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
British East Indies	29	3,600	.....	....	29	6,620	36	11,543	234	164,684	44	24,000
French Indo-China	.....	....	.....	....	.....	....	.....	....	198	76,382	1	2,000
Dutch East Indies	87	21,781	264	54,896	133	33,260	305	143,200	486	196,678	209	112,000
China	46	7,061	.....	....	50	9,600	.....	....	.....	....	.....	....
Japan	35	19,853	1	2,960	8	8,062	1	2,288	127	118,085	423	367,000
Australia and New Zealand	28	3,900	.....	....	.....	....	127	83,800	93	52,209	39	44,000
Philippine Islands	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Canada	.....	....	3	2,030	.....	....	.....	....	12	20,297	.....	....
United States of America	89	28,266	108	48,526	20	10,891	646	667,309	2,608	1,510,927	205	281,000
Mexico	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Central America	.....	....	1	1,006	.....	....	1	1,200	.....	....	.....	....
Brazil	1	120	31	6,025	104	26,783	101	37,398	739	237,295	217	80,000
Colombia	.....	....	12	4,444	.....	....	.....	....	.....	....	.....	....
Argentine	15	3,384	19	7,700	30	6,473	20	15,275	314	134,494	55	50,000
Chile	.....	....	.....	....	.....	....	.....	....	.....	....	.....	....
Other countries	.....	....	.....	....	.....	....	.....	....	5	3,948	195	95,000
Total	152,312	48,661,857	116,932	45,443,739	57,044	23,803,710	72,115	32,114,602	81,360	36,081,234	26,956	12,663,000

Value of Franc at parity is 19.30c
q. n. = net quintals or 100 kilograms = 220.46 lb.

The Disease Called Drafting—Discussion

By Elam Whitney

On page 643, vol. 57 of the *American Machinist*, Entropy refers to a comparatively new profession as a disease. The writer is of the opinion that this disease seldom becomes chronic as substantiated by the absence of old men engaged in the profession, as they either die before they get to be 45, get a transfer to some other department or enter into business for themselves. The writer could cite many cases of very capable draftsmen and designers who are saving every possible penny toward the purchase of a cigar store, gasoline filling station, etc. A friend who was considered a very good designer, formerly with two of the largest manufacturers of machine tools, resigned at the age of 35 years to engage in photography as a better business proposition. A designer of adding machines, about 37 years of age, has been working for over a year as a street car motorman. In the opinion of some, these men were "old" men, as witnessed by an advertisement in the help wanted columns of a St. Louis newspaper for a successful business man aged 25. At this rate the high school boy of the future will be playing the stock market.

Promotions Are Infrequent

The drafting room does not attract the ambitious, aggressive type and the writer's advice to the young graduate is to learn the profession if he wants something to fall back upon and then get into something else for, just as Entropy states, the promotions made from the drawing room are few and far between. Is drafting a profession or a trade? It is certainly considered a trade in some factories where the drawing room is located in one corner of the machine shop, the master mechanic acting as chief draftsman when he has time. The hours are the same as factory hours, 7 a.m. to 5 p.m. and sometimes until 5.30 or 6 p.m. The rate is an hourly one and the draftsman is "docked" for being late or sick.

Just as fair for the draftsman as the mechanic some reader will say, but either he is incorrect in judgment or unaware that many draftsmen have spent four years or more in an engineering school to acquire the knowledge which the average mechanic will not sacrifice his spare time to obtain. It looks easy to sit at a drawing board and push a pencil, but have you ever observed how few mechanics and tool makers stick to it after a trial? Good tool and diemakers are now averaging more pay than experienced and technically trained designers. The draftsman has one opportunity and that is to become the chief-draftsman but the latter seldom resigns. A good tool-maker may become an experimental engineer or foreman, tool room foreman, production foreman or chief inspector and any of these positions may prove to be stepping stones to general foreman or factory manager.

Twelve years ago a mechanical paper published a table which recorded two of the largest and oldest manufacturers of machine tools, located in different parts of the country, as working their draftsmen 10 hours daily and 9 hours on Saturday. The war changed this just as it caused a vast change in industry in general.

Drafting requires intense concentration and constant study and several years of the work will put a man into a groove which rapidly deepens into a rut, causing a loss of perspective. Then again the lack of contact with workmen throughout the factory makes the designer unfit for executive work.

The cure is to place the various designers at work in different parts of the factory for certain periods; not exactly an apprenticeship system but more of a post graduate course. This will result in better and more practical designs, better co-operation between drawing room and factory and a field from which may be selected better department heads and other executives.

The Law and Trade Associations

By J. Bainter

The status of trade associations in the eyes of the law has not received much attention during the past few months, but the question is still a very live one and deserves a little attention. Trade associations are regarded by most of the law-makers and executives at Washington as being necessary evils and they are conceded to have a place in the business and industrial world. The trouble is that this place is made a minor one, so that the usefulness of the associations is greatly impaired.

It is perfectly legal for representatives of industrial concerns to get together and talk over methods of production, markets and the many other phases that enter into the conduct of an industry. But when prices are spoken of, and should any reference be made to future prices, then these business men become law-breakers. This hampering of price discussions is what makes the trade associations less useful than they should be, and prevents them from exercising the greatest influence for good that could be given a business or an industry.

The most necessary and the most vital discussion to all business is that on the subject of prices and their control. There is a great deal that can be spoken of on this subject without entering into that field which is morally wrong—the monopoly control of prices for gouging the public.

Although this argument may sound a little unreasonable to Americans in general, it is strictly in accord with the legislation of other countries. Our laws with reference to trade associations make illegal here those things that are approved of abroad. Just viewed from that angle, it seems unfair to American business men to prevent them from co-operating on a subject of such vital importance, particularly when they enter into competition with these foreign manufacturers in export trade.

The chief and best remedy for the situation lies in relieving business of some of the legislation that now encumbers it. Although it may be possible to add some legislation that would be beneficial, the best step would be toward lightening the burden of legislation rather than adding to it. The Edge Law is a step in the right direction, but something more is needed.

What is needed is an amendment of the Sherman Anti-Trust Law, so that it will still prevent the monopolies, for which function it was created, but will not interfere with the ordinary conduct of private business. There is really nothing to be afraid of in this step, as the spirit of the original law can still be maintained. Such a step, allowing trade associations to discuss prices, would be a boon to the associations. It would give to them and to their members the stability that comes from a knowledge of existing business conditions and a reasonable insight into the future.

Testing Abrasive Wheels

Characteristics of Wheels Used for Different Purposes—Machines for Testing Hardness of Bond and Abrasive Qualities of Wheels

By H. H. LaVercombe

THE MANUFACTURER of abrasive wheels is many times unjustly condemned when the proper results are not obtained by the user, owing to the fact that the information given by the user as to what is required is inaccurate. The producers of practically every article requiring to be ground are spending fabulous sums each year for unnecessary labor, power and wheels, through the use of wheels that are not properly adapted to the work in hand. I know of no other line of manufacture or industry where so much personal service is required as in the manufacture of abrasive wheels, and the fact that so much personal service and instruction are given, indicates an earnest desire on the manufacturer's part to give the best there is in him.

Now the fact that almost any abrasive wheel will grind (and it is difficult to tell when the maximum amount of grinding is being done) makes this problem more complex, for an operator will often consider that a wheel is giving satisfactory results when the surface produced is pleasing to him, regardless of the fact that the amount of work done in a given time is ridiculously small. Into this error he is often led by an unscrupulous but persuasive salesman.

Bond of Snagging Wheels

In a wheel, intended for snagging or rapidly removing metal, it is necessary that the bond be of the proper hardness or density, so that it will hold the grains of abrasive material in place until each one has performed its maximum amount of work, and the sharp points have been worn off leaving round or dull surfaces. The worn grains should then be released, allowing new and sharp ones to appear upon the surface. On the other hand, if a wheel is intended to be used for producing a polished surface, it is necessary that the bond be hard or dense enough to hold the abrasive grains until they have performed the maximum amount of work, and yet not long enough to cause the wheel to become clogged with particles of the material being ground and thus produce a glazed surface.

There is a vast difference in the amount of work which may be done, without sacrificing the "satisfactory finish," with wheels of the same grade and grain made by the different manufacturers. This difference may be due to any of the following causes: Accurate or inaccurate grading, careful or careless supervision in the manufacturing departments where the wheels are made, good or bad abrasive material, good or bad bond, proper or improper baking, etc. The writer has in front of him at the present time the analysis of some recent tests with four different makes of wheels showing that the cost of removing one pound of steel with one pound of wheel, ranges from $2.05 to $4.58, despite the following facts, i.e.: each wheel was made by a manufacturer having a national reputation; each wheel was supposed to be of the same degree of hardness or density of bond and to contain the same size of abrasive. Each wheel was expressly recommended by its respective maker's representative for the particular work on which the tests were made.

Effects of this nature in our manufacturing department compelled us to look for the cause, and in doing so we were so impressed that we commenced experiments which finally led to the development of abrasive wheel testing machines. These machines enable us to properly inspect all wheels upon their arrival in our receiving room, in the following manner:

To determine the hardness or density of bond, the wheel is laid on the table of the machine shown in

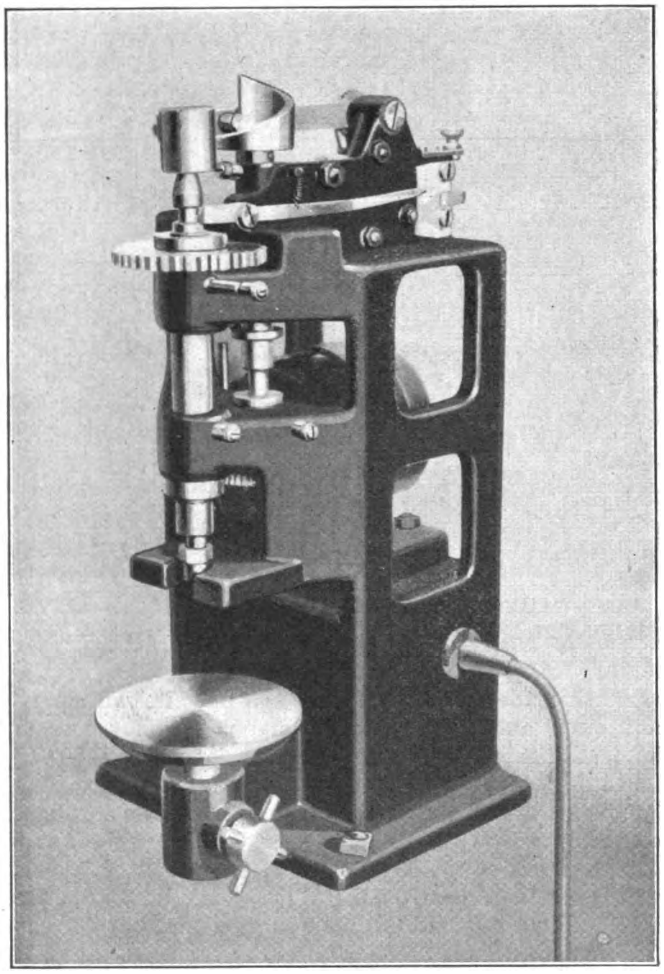


FIG. 1—MACHINE FOR TESTING CHARACTER OF BOND

Fig. 1. When the machine is set in motion, it raises at each revolution, a hammer of the correct weight to a certain height and then permits it to fall on the top of a spindle carrying a flat drill held in contact with the side of the wheel being tested. After each blow of the hammer the drill is turned a fraction of a revolution. When a pre-determined number of blows have been delivered the machine automatically stops and the depth of the penetration may then be readily determined by an indicator which is an integral part of the machine. As the hammer is impelled by gravity the same

number of blows struck in all cases and the area of the face of the drill always being uniform, the record of the resistance offered by the bond is very accurate.

The abrasive capacity is determined as follows:

The wheel to be tested is laid on the table of the machine shown in Fig. 2. A disk of the material to be ground is revolved at the proper speed, being held

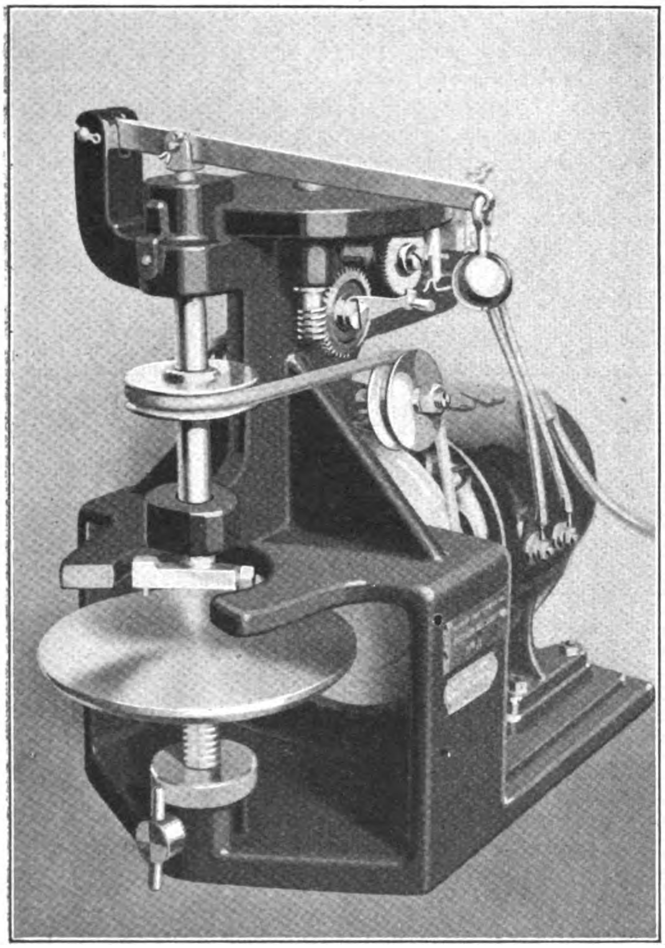


FIG. 2—MACHINE FOR TESTING ABRASIVE CAPACITY

in contact with the abrasive wheel under the proper weight. After certain number of revolutions of the test disk made in this manner, the machine automatically stops and the amount of material removed from the test disk may then be readily determined by an indicator which is an integral part of the machine. Complete tests may be made on both machines in about four minutes.

In the work of tool salvaging, we use grinding wheels exclusively to remove the metal necessary to reform the tools. Hence the value of these two machines to us has been inestimable.

Who Has This Information?

Daniel Adamson, of Joseph Adamson & Co., Hyde, Cheshire, England, is looking for a reference to "interchangeability" that he believes was made in a discussion before one of our national societies about 20 years ago. Three degrees of interchangeability were referred to: first, when the spare part could be adapted by slight alteration; second, where the spare part required radical alteration in the workshop before it would fit its intended place, and, third, when the spare part was of such a different pattern as to be useless.

The Foreman as an Element in Management

By Entropy

The point of view in the discussion of this subject seems to depend very largely on the size and kind of shop under discussion. About all that is admitted by all hands is that their problems are "different," which makes the problem very much like all the other problems of management. Take, for example, a shop of my acquaintance, which began some years ago with six or eight workmen, one of whom was called foreman, mainly because he kept time on the other men for the owner who had other things which kept him away for the better part of the day. He was really superintendent, works manager, and about everything except treasurer and sales manager in terms of a large shop.

Then there is another shop, having some hundred or more foremen and two or three hundred straw bosses, in which no foreman performs any functions above those of his title. That is, none of them buy any materials, they requisition it from the stores: they do not decide the wages of their men, except on approval of several other men higher up in the organization. In general, they accept orders as to what to do, accept the men sent them from the employment office and the materials from the stores, which is largely sent them automatically as the work is shunted around the shop on a schedule. They are foremen stripped of most of the things that make a foreman's job interesting.

Looking back over the jobs I have had, and comparing those that I have enjoyed holding with those I enjoyed leaving, I am struck with the fact that those I liked to stay on have been those in which I knew what was going on. When I have been where doors were shut in my face and I was not in "the know" regarding things which vitally affected my work, I was only too glad of a chance to get out. It is very much like a man working in a shop alongside a railroad. If the windows are glazed with opaque glass, "To better distribute the light" he is always wondering just what minute a locomotive may get off the rails and tear into the shop.

Importance of Alloy Steels

An illustration of the importance of alloy steels is given in production statistics recently issued by the American Iron and Steel Institute. Despite an extremely low tonnage for the whole industry in 1921, the relative amount of alloy steel remained very close to its record 1919 figure.

TABLE OF PRODUCTION OF STEEL INGOTS AND CASTINGS AND OF ALLOY STEEL INGOTS AND CASTINGS IN THE UNITED STATES
[000 omitted]

	Total Steel, Gross Tons	Alloy Steel, Gross Tons	Alloy Steel of the Total, Per Cent
1909	23,955	181	0.75
1910	26,094	567	2.17
1911	23,676	481	2.03
1912	31,251	792	2.53
1913	31,300	714	2.28
1914	23,513	646	2.75
1915	32,151	1,021	3.17
1916	42,773	1,362	3.18
1917	45,060	1,644	3.65
1918	44,462	1,787	4.02
1919	34,671	1,481	4.27
1920	42,132	1,660	3.94
1921	19,743	809	4.10

Methods of Machine Tool Design

Principal Uses of Cams in Machine Tools—Cams for Holding and Clamping Devices —Cams as Feed Rate Variators—Contour Milling

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

CAMS are used for so many different functions that it is almost impossible to make a complete list of them. However, we are concerned only with their use in machine tools, and it may be said that in this class of machinery they are used mainly: for drives, for feed, for operating trips, for opening and closing holding devices, for operating magazines, for clamping, for belt and gear shifting devices, for indexing, for timing of movements, for stop motions, for regulating rate of feed, for generating irregular shapes.

Cams are not essential, or even very useful, for drives; cranks or eccentrics can almost always do all a cam can accomplish. They may be useful to a small extent for filing machines or for machines where two or more tools must work on one piece and where they would interfere with each other unless they were timed properly. Cams are the logical means to effect such timing.

We have already seen how cams can be used for feed. Their usefulness for this purpose is due to the fact that they produce a definite length and location of the feed stroke with any desired rate of feed and provide for a rapid advance and return, all without complication of mechanism and without reversing or fast running parts. Where intermittent feed is required they determine the exact time of the feed. One finds cams employed in this manner in slotters. The other uses of cams have been merely touched upon and we will now go a little further into some of them.

The actuating element used for tripping machine parts, such as clutches, etc., is the dog. A dog is a cam of very simple shape; it may be merely a pin or a triangular piece of metal fastened to a moving part and acting on some lever or slide so as to produce the required movement of a clutch, drop worm or other machine element. Sometimes a more complicated construction is used for dogs. When a dog is fastened to a reciprocating part it may be required to be active going in one direction and inactive in the other. In such cases the dog may be hung from a pin and be prevented from movement in one direction by an abutment while movement in the other direction is permitted. The weight of the dog, or a spring, may bring it back to normal when it has been lifted up on its backward course. See Fig. 193.

Similar devices may be used when it is desirable that one should be able to start a feed or drive immediately after it has been stopped and when it is not desirable that the operator should be compelled to hold his hand on the starting lever until the entire dog has passed the tripping point. Cams may also be used for placing certain machine parts in the position where they can be tripped by some other element. Still another function of a cam for the purpose of tripping is preventing a trip from being carried out completely.

We may imagine a clutch somewhere in the mechanism which can be tripped from right to left and vice versa. Let us say such a clutch is used in a tapping mechanism. In such a mechanism the tap should go forward up to a predetermined point, then the clutch should be reversed so as to bring the tap back by revolving it in the opposite direction, after which the same clutch should be tripped again. This time, however, it should be prevented from engaging the mating part on the other side. In short, after starting, the clutch should be automatically tripped from right to left and then from left to right, but should be prevented from completing this latter motion. It should stop in the center where it is out of engagement. This is ordinarily done by interposing an obstruction and doing this by means of a cam.

Cams for opening and closing holding devices are well known. They are used in automatic screw machines and in various other automatic machines where the work can be gripped automatically. Instances of cams for the opening and closing of holding devices for machines outside of the class of screw machines are not generally well known. They are used to a large extent for this purpose in special machinery and particularly for the purpose of gripping a piece and carrying it from one operation to the other. Pieces may be located in a magazine or hopper and a set of fingers, operated by a cam may pick up one piece and insert it in the spindle of the machine.

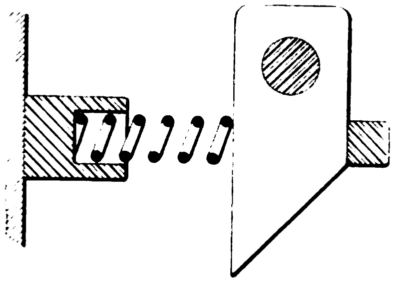


FIG. 193—DOG FOR RECIPROCATING MACHINE PART

After the required operation is completed, another set of fingers may pick up the piece before it is released by the spindle, turn it around, and insert it in another spindle for an operation at the other end. In the case illustrated here, cams are used four times for operating holding devices, twice for the chucks and twice for the gripping fingers. A well-known illustration of this kind is the slotting attachment used with some screw machines. Another illustration is the magazine feed for certain kinds of screw machines. Nothing need be said about these cams, except that they should be quick-acting and, as a rule, *can* be made very quick-acting because the parts to be moved are light and the only work to be done is the work of transferring. Some caution is required in the proportioning of the transfer fingers because too rapid a movement of the piece might make its location uncertain. Another point to be cautioned about is that as a rule the holding device picks a part out of the spindle and must grip it before the piece is released.

For this reason, the gripping must be of a gentle nature so as not to spoil the work or cause too much wear of the fingers by the gripping pressure. As the piece is held gently, it should not be swung around at too great a speed for fear that it may escape from the fingers. There are many kinds of magazine feeds in

existence, some of which do and others do not require cams. The action of such cams is in no way different from cams heretofore discussed. They are, as a rule, slow-acting and do not present any special difficulty.

On the other hand, cams used for clamping devices should be carefully thought out. Where clamping can be done by means of a toggle joint or some other device which can be brought over the center, nothing need be specially considered except the amount of pressure required. Cam and roller should be proportioned accordingly. The toggle joint in itself has provided means for exerting great pressure at the clamp without much pressure at the roller, but in cases where no such device can be employed, great pressure on the roller may be required.

In such cases it is essential that the cam become more and more gentle acting as the clamping point is reached, so as to be able to exert a great pressure without much effort at the circumference of the cam. In such cases there is always the possibility that there will be a certain amount of variation in the piece to be clamped and this may cause insufficient clamping at one time or an extraordinary amount of pressure at another. It is well, therefore, between the cam roller and the point where the clamp is applied to have some element which has enough elasticity to permit of a certain amount of spring.

As a rule, cams used for belt shifting devices are assisted by a spring or weight or some other means by which the shifting of the belt may continue for a short time after the cam has ceased to act. This is often necessary because the amount of time required for shifting is an uncertain element. It may well be that the part of the cam which is used for the shifting is past before the belt has completely changed over from one pulley to another. Making the cam act on a device provided with spring or weight which will complete the belt shifting makes the operation more certain. On the other hand, the uncertainty of timing remains and cannot very well be overcome. It can be held to a minimum, however, by making the belts to be shifted narrow and running them at high speed.

Cams for Shifting Gears

It is not advisable to use cams for automatic gear shifting on account of the uncertainty as to whether the gears will mesh or clash, but for hand shifting devices cams can sometimes be used to advantage. For instance, where there are several sets of sliding gears a cam may be arranged so as to pick up one pair of sliding gears, shift it to left, then to right, then to center, then pick up a second set, shift it to left, then to right, etc., so that the mere rotation of a crank will bring successive feeds or speeds into action without any attention on the part of the operator.

In many cases the indexing is performed by some special device and without the aid of cams. Such a device, however, must be kept in time with the cam and may be started by a cam. In other indexing devices the cam itself may perform this function by moving a lever or segment which performs the operations of withdrawing the locking pin, moving the index wheel, and releasing the locking pin so that it will drop in at the proper spot. The amount of motion which the cam would give to this lever or segment would be more or less uncertain, and if no special provision were made it might well be that the lever would still be attempting to move the index wheel after the bolt had shot in place. To avoid such interference, the lever or other device is often provided with a pawl which is lifted out of action by a pin placed at the proper point. An essential feature of such a device is that the index must be started and stopped at practically zero speed. The stopping especially should be very gradual, so that the momentum of the wheel shall not carry it too far. Not only the momentum of the wheel but that of the turret or other part which is indexed might cause an error in positioning. For that reason the cam must be laid out in such a way that the end of each operation takes place at a vanishing speed.

Timing Cams

One might say that all cams are used for the timing of movements, because they give a closed cycle of operations of which the sequence as well as the nature itself is determined by the cam. However, there are certain cams in use of which the most important purpose is the timing of operations. As a rule such cams take the form of a disk to which dogs can be attached. A clean-cut instance of this kind is furnished by the Brown and Sharpe screw machine in which disks are employed to which dogs can be attached. These dogs operate various levers which start single-revolution clutches. The position of the dogs on the disk determines at what particular point of the complete cycle each one of these clutches shall make its turn and perform its work.

The term "stop motion" is not commonly used in machine tool practice, but is used in the design of other kinds of machines, particularly automatic machines. It indicates a mechanism by which the movement of the entire machine or part thereof is stopped at a predetermined moment. A drop worm or a clutch which can be disengaged by the action of a dog are instances of stop motions. An illustration of a stop motion operated by a cam is the single-revolution clutch which was described before. This clutch is normally out of action because an obstruction, resting against a projection of the clutch, keeps it away from its mating part. When this obstruction is removed, a spring behind the clutch throws it into action. Before the clutch has made the desired number of revolutions the obstruction is once more placed in position and toward the end of the last revolution a cam-shaped projection built onto the clutch rides along this obstruction and causes the clutch to be withdrawn.

Cams are also used for the regulation of the rate of feed. We have no reference here to the fact that the slope of a cam strap or cam groove itself determines the rate of feed but rather that a cam may be used in such a way as to affect the rate of feed produced by some other mechanism. As an illustration of this kind we mention the Cleveland automatic screw machine. In this machine there is one cam for the turret tools which causes the turret to move forward and backward the same amount for each of the different turret positions. There is a fast and slow motion provided, but there cannot be any variation in the slope of the cam. The slow motion, which, of course, is used for the feed, would always have to proceed at the same rate unless some other means were provided to change it. Such means are present in the Cleveland machine in the form of cams.

The cams are of the very simplest nature, being merely strips of metal fastened to the circumference of a wheel of large diameter in such a way that they can project more or less beyond the edge of the rim. As each of the strips is fastened by two screws going through slotted holes, it is possible to set the strip of

metal either parallel with the rim or at a slight angle. The strips operate on a lever which moves the friction disk of the feeding device. Lowering or elevating the friction disk causes the feed to run at a higher or a lower speed. If the strips are set parallel with the rim of the wheel the feed will remain constant so long as one particular strip passes the roller, but the next strip, set further forward or backward, may move the friction disk one way or the other and thus cause a different feed rate. The feed rate, then, remains the same during the passage of one strip past the roller, provided the strip is set parallel with the rim of the wheel. When it is set at an angle, however, it will cause the friction roller to move during the passage of that strip and may cause an accelerating or retarding rate of feed. If desired, strips can be made with a contour which will give any kind of variation to the feed rate during the passage of the strip.

Such a device meets almost all conditions met in practice. The use of a friction device for feed makes the feed rate itself somewhat uncertain, not only because there is necessarily some slip which may vary, in amount according to the condition of feed disks and roller, but also because the rate of speed changes so rapidly for a small amount of adjustment of the roll that it is not practical to depend on this device if a certain predetermined amount of feed must be obtained. In such cases a positive drive for the feed must be employed and the variation in rate must be obtained in some other manner. Figure 194 shows such a device in elementary form.

To make the action of this device somewhat clearer we will take a concrete example. *A* is a piece of work of which the edge must be milled by cutter *B*. The piece is mounted on a turn table which is rotated by means of worm wheel *C* and worm *D*. The piece is supposed to be located centrally on the turn table. It will be seen that when the cutter is at the point *P* the rate of feed is in proportion to the line *OP*, whereas when the point *Q* is opposite the cutter the rate of feed will be proportionate to the line *OQ*. If the same rate of rotation of the worm wheel were maintained, we would have

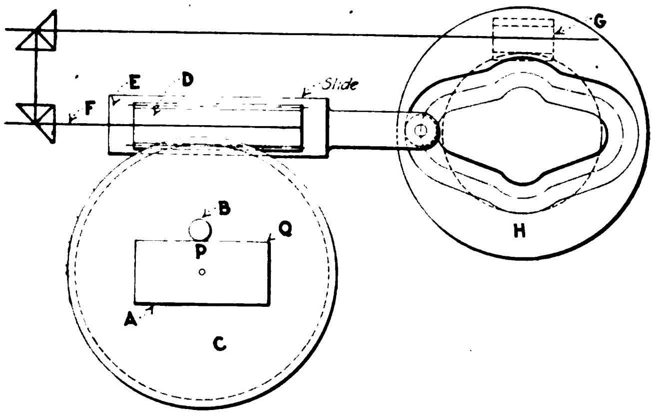


FIG. 194—POSITIVE VARIABLE FEED DEVICE

a much slower feed at *P* than at *Q*, and this would mean that either we will get an undesirable finish at the point *Q*, if the rate of feed is correct for *P*, or else that we will lose considerable time if the rate of feed is correct at *Q*.

The worm *D* with its thrust bearings is mounted on a slide *E*, and is driven by the spline shaft *F*. This shaft also drives a worm *G* through bevel gears, as indicated in the sketch, or by some other means, causing the worm wheel *H* to turn in unison with *C*. Mounted on the worm wheel *H* is a cam which causes the slide *E* to move backward and forward. This movement of the worm *D* will accelerate or retard the movement of the worm wheel *C*, and by giving the cam the proper shape we can give this worm wheel *C* such a variable motion that the rate of feed remains constant at any point of the work. In the sketch the cutter *B* is shown at a certain distance from the center *O*, and it is very obvious that this distance should be variable.

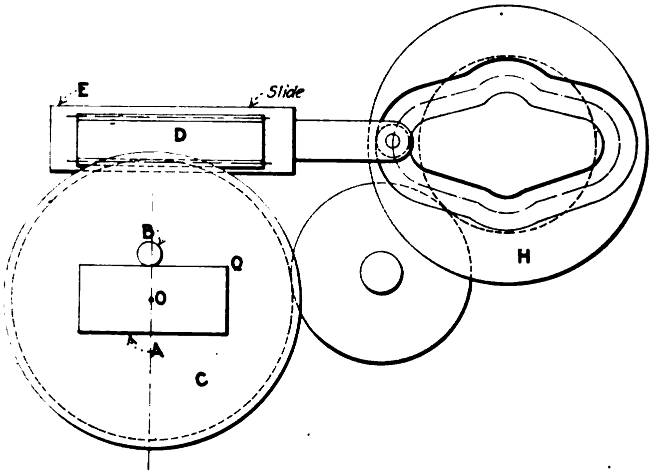


FIG. 195—MODIFICATION OF FIG. 194

This is easily obtained by mounting the cutter head on a slide which is moved backward and forward by means of a templet mounted on or under the worm wheel *C*. By giving the templet the proper shape the cutter can be made to take the proper position in relation to the work while *C* rotates.

With this construction it is rather difficult to lay out the correct shape of the cam on *H*, and for that reason it may be better to modify the arrangement as shown in Fig. 195. In this arrangement the cam is mounted on a spur gear, driven in unison with worm wheel *C* by means of another spur gear mounted on this latter worm wheel and by some idlers. Doing this simplifies the laying out of the cam materially. If the normal movement of worm wheel *C*, that is, when the worm *B* does not have any lengthwise motion, is such that the feed is correct for the point *P*, then we can easily find how rapid the movement of worm wheel *C* should be for a point P_1, located, let us say, 10 deg. to the right of point *P*. We can also figure out how much one inch movement of the worm *D* causes the feed to be retarded or accelerated, so that it is easy to figure at what rate the worm must be moving and in what direction when the cutter is opposite the point P_1.

As the cam rotates in unison with worm wheel *C*, we have found the rate of change in the cam shape at a point 10 deg. removed from the starting point. Working in this manner we can lay out the direction of the tangent of the cam every 10 or 5 or any other number of degrees. It should be noted that the cam in this case necessarily has a reversing action, that is, it sometimes pushes and sometimes pulls the worm slide. At the moment when the action changes from a push to a pull, there will be a certain amount of lost motion between the cam and the roller and this might have its effect on the finish of the work. Though the lost motion may be very small, its effect will be very great for the following reason:

Suppose the cutter to be opposite the point *Q*. The

action of the cam between P and Q has been to retard the movement of C. At Q this movement must suddenly change to an acceleration. If there is lost motion, then there will be neither acceleration nor retardation. In other words, there will be a moment at the point Q when the machine acts as if this device were not in existence, so that the feed will be the same as it was at the point P, which is entirely too fast. To overcome this difficulty, one should make a cam in the form of a face cam and depend on a spring, or preferably a heavy weight, to keep the roller against the cam edge, thus avoiding all lost motion. The cutter slide also should be held against the templet by means of a weight or spring.

The use of cams for generating irregular shapes is well known. Cams used in commercial machines are

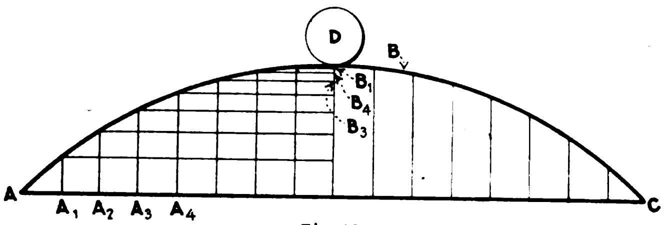


Fig. 196

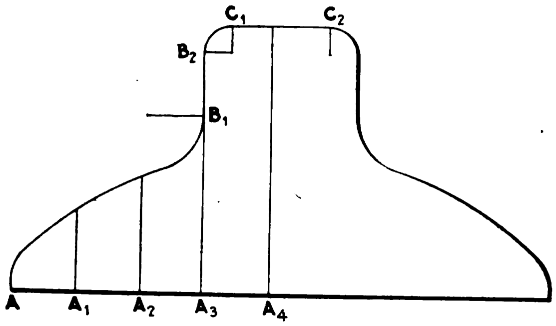


Fig. 197

FIGS. 196 AND 197—OUTLINES MADE BY TOOL GOVERNED BY CO-ORDINATE SLIDES

themselves the product of other cams. There are two distinct ways in which cams can be used for generating various contours. In the first place, a cam may be used as a templet, producing a copy of itself. Cams are used in this manner in cam cutting machines and attachments. In the second place, they may be used for the purpose of modifying the movements of some machine element so as to produce an outline depending on the shape of the cam but not a copy thereof.

If we should mount a cam on a shaft, hold this shaft in bearings mounted on a slide and then mount another casting of similar dimensions to the cam on this shaft, we have the elements of a cam cutting machine, or rather of a cam reproducing machine. If a stationary roller is held in contact with the first cam and a cutter of the same size and shape as the roller is made to act on the second drum, then all we need to do to reproduce the first cam is to give it a rotary motion. This principle of making cams is carried out in many modified forms. Cam cutting machines, automatic profiling machines and many special machines depend on this principle.

An entirely different method of making irregular contours is by means of two cams which act on two slides, moving at right angles to each other. This method corresponds with the construction of a curved line by means of its co-ordinates. The abscissas are laid out by one slide and the ordinates by another. In Fig. 196 the curved line ABC is supposed to be made in this manner. D is the cutter. The cams must be so constructed that the distances AA_1, A_1A_2, A_2A_3, etc., are traveled in equal times; and the other cam must be so constructed that the distances BB_1, B_1B_2, B_2B_3, etc., are traveled in equal increments of time.

It is always possible, of course, to make the distances AA_1, A_1A_2 equal, which means that we can give one of the slides a uniform motion by means of a screw or rack or similar device, in which case only one cam would be required to produce the contour; and such a method would probably be followed if a piece of the shape as shown in Fig. 196 had to be produced. If a piece had to be produced such as is shown in Fig. 197, it would no longer be possible to move one of the slides by means of a screw. The distances AA_1, A_1A_2, A_2A_3, are again equal. At A_3 the other slide must move from the point B_1 to B_2 without any further movement of the first slide; which, of course, would be an impossibility because the speed would be infinitely large in the direction of B_1B_2.

If cams were used, all that would be necessary would be to have a part of the A cam made with a dwell, while a part of the B cam makes the piece travel from B_1 to B_2. Similarly, it is not possible to have a screw produce the movements in the B direction because in that case there would have to be an infinite speed in the A direction while the contour is made between C_1 and C_2. Generally speaking, an ordinary feed such as the screw feed can be used in combination with a cam feed when there is never a large ratio between ordinates and abcissae, such as is the case with the contour shown in Fig. 196, but it becomes impossible when this ratio becomes large. Even if the branch B_1B_2 in Fig. 197 had not been vertical but merely a steep slope, a screw could not have been used in combination with a cam.

Making a piece to an irregular contour is generally accomplished by the process of milling though, in a few cases, it is done by slotting, shaping or planing. When an irregular piece is produced by milling, the size of cutter which is to be used should be considered in the laying out of templet or cam. Referring again to Fig. 197 it will be seen that if the cutter which is actually used should be smaller than the cutter which was considered when the cam were laid out, then the branch B_1B_2 would come too far to the left, and the other vertical branch too far to the right; whereas the horizontal branches would also have been spread apart. Altogether, the piece would have been distorted. As a rule the desired accuracy in a piece is not so great but that a small variation in the size of the cutter can be allowed.

Generally speaking, in automatic contour milling we will meet the same conditions as in profiling on a hand operated machine. In the latter type of machines the trouble is sometimes overcome by making the guide pin or tracer taper, so that it is always possible to have such a diameter of the tracer bear against the templet as corresponds to the diameter of the cutter used. This method could not be followed in automatic profiling, because there is no tracer in this case.

When disk cams are used and the roller is always held against the cam, say, by a weight, we might make the roller taper, but then it would bear against an edge of the cam only, and this would not be practical except for the lightest kind of work. Another method is also

sometimes followed in profiling, and that is that two cutters are used to make the piece, one for roughing, the other for finishing. Wear in the roughing cutter is compensated for by the finishing cut, and wear in the finishing cutter is, of course, very small. Thus, a great many pieces can be made with this finishing cutter before it will be necessary to re-sharpen it. A small amount of variation in this finishing cutter is, of course, permissible, let us say a few thousandths, and after it has become too small to be of further use as a finishing cutter, it can be used as a roughing cutter. This method can be employed with automatic milling, but, naturally, only when two cuts are taken.

Advantages and Disadvantages of Cams

Cams offer unlimited possibilities as to the nature and combinations of motions of machine elements. It would be perfectly possible, for instance, to have one's signature produced by a pen by the movement of two slides guided by two cams. There is hardly any kind of movement imaginable, either in one plane or in space, which cannot be produced by cams, and when once the cams are designed the simplest kind of mechanism is, as a rule, sufficient to drive them. Other advantages have already been mentioned, such as the fact that they provide a definite limit of stroke without danger of over-run, that they will give variable speed or motion in opposite directions without complicated mechanism or without reversal of parts, in fact, the advantages of cams are so many and so well recognized that they are often used where other mechanism might have been employed to better advantage.

Like everything else, a cam has its disadvantages as well as its good points. There is, in the first place, its limited capacity as to power or pressure. Generally speaking, cams are not well adapted to heavy duty machines. In the second place, they take large dimensions as a rule and are not easy to place in a covered mechanism. Another disadvantage is that they are limited in their scope. It is easy enough to construct a cam to give a movement of 6 in. but not of 6 ft. Not only that, but it is not possible to produce anything else but 6 in. unless additional mechanism, such as levers, etc., are introduced. Finally, there is the difficulty of making the cam. There is, at the present time, no means of generating a cam, though there is no reason why a generating machine could not be made for certain classes of cams.

Economy Justifies Making of Tracings

By S. N. Bacon

The writer has often observed the almost universal practice followed in small shops and factories where only one or two draftsmen are employed, of using the heavy or "cream" drawing paper for the drafting of patterns, punches, dies, miscellaneous tools and sometimes parts for manufacture. Most draftsmen and tool designers agree that practically the only advantage of this material over the bond and vellum papers is its erasing qualities, the medium grade being about the same in price. The idea of saving the cost of the blueprint, the writer believes to be mistaken economy.

Its disadvantages are several. In making the drawing, quite frequently time could be saved if partial views were traced from other drawings, or the outline of the work were traced as is usually done in jig and fixture design. Then again, it is sometimes convenient to trace a part from the reverse side to change it from right-hand to left-hand. Another disadvantage is the necessity of sending the original drawing to the pattern shop or toolroom, which leaves the designer without a copy for reference; this procedure is especially inconvenient when the work is done by outside shops.

Dirt May Be Dangerous

It is not easy to keep these cream-colored drawings clean in the factory, and the danger of mistakes arising from thumb-printed dimensions is not an imaginary one. It is disagreeable to handle these drawings after they return from the shop, not because the designer is so adverse to getting his hands soiled, but because the sheets are usually very much soiled on the reserve side with black grease due to laying the drawings on the work bench. Thus, when referring to the old drawings, new drawings in the course of preparation are soiled.

Manufacturers of drafting supplies have been furnishing for some years a fairly tough grade of vellum or tracing paper which is equally as transparent as linen tracing cloth and much lower in price. Erasing pencil marks from this material is not difficult if the designs are made with a pencil not harder than 4H. Ink should seldom be used on vellum, as a satisfactory blueprint can be made from the pencil tracing.

Drawings requiring more than two or three days to complete should be traced on linen and blueprints of them, especially from tracings of parts to be manufactured, should be filed in a fireproof vault so that in case of fire no time would be lost in replacing tools and equipment, and the expense of designing all over again would be eliminated. The above economies will more than pay for the cost of blueprinting.

Personality and Pessimism

By Charles W. Lee

I was once severely criticized by a professional optimist. He said that I was a pessimist, that pessimists were all wrong, and that I was harming not only myself but the world at large. After much more in the same strain he demanded to know how I happened to be a pessimist anyhow.

My reply was that if I were a pessimist it was probably because I had designed so much machinery—although possibly it was the other way around—and that no one not a pessimist could be a good machine designer because the first thing necessary after completing a design was to say (quoting good old John Fritz): "Now let's go and find out what's the matter with it."

And that goes!

The most ingenious machine designer I ever knew was also the greatest optimist. He never could see anything the matter with his designs, so it always fell to me to go through the drawings and pick out the "bugs" that were always there, I being only a poor pessimist who could see a bug across the room.

Incidentally the optimist received a much larger salary than the pessimist, which leads me to believe that my critic was right when he said I was harming myself, but I still contend that I was not harming the world.

And anyhow I claim to be neither an optimist nor a pessimist but a rationalist, because I picked only the bugs out of the optimist's drawings, seeing the good and letting it remain. After all, a pessimist is only "one who has to live with optimists."

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Errors in Checking Cylindrical Work in V-Blocks

By A. H. Frauenthal

The writer was recently in discussion with the manufacturer of a rather well-known amplifying gage concerning the application of the V-block in measuring

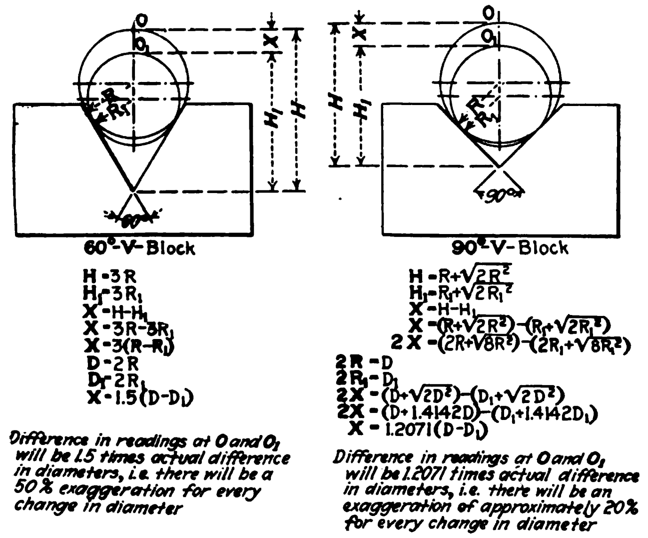


FIG. 1—HOW VARIATIONS IN DIAMETER ARE EXAGGERATED ON WORK CHECKED IN V-BLOCKS

size variation and roundness of cylindrical objects, and was very much surprised to note that the gentleman in question was not conversant with the fact that the ordinary V-blocks in general use, and similar to the V-blocks on some of his own machines, greatly exaggerate both variation of size and amount of out-of-roundness, particularly on centerless-grinding work. I am, therefore, sending you this article which may be of help to others who have never considered the error in this method of checking.

Herewith, in Fig. 1, is a sketch, also figures showing

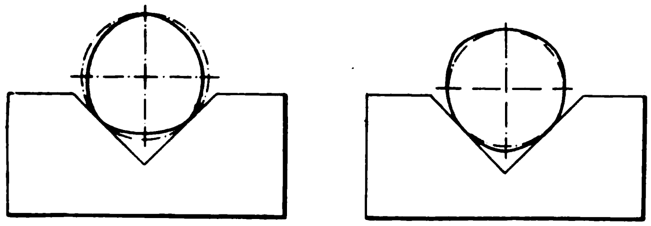


FIG. 2—ANALYZING TRIANGULAR OUT OF ROUNDNESS

the error of exaggeration in both 60- and 90-deg. angle V-blocks. This explanation shows the magnification of variation in diameter and it can readily be seen by the sketches of triangularly out of round cylinders in V-blocks in Fig. 2 that the measuring of out-of-roundness of a triangularly shaped piece is nothing more or less than the comparison of size of the inscribed and circumscribed circles of the triangle.

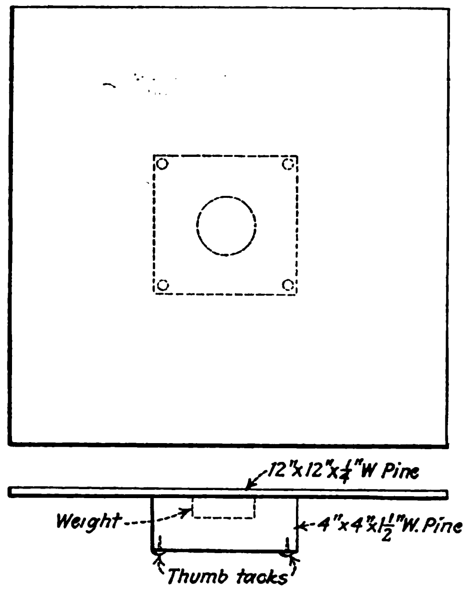
It is, of course, understood that the out-of-roundness produced on a centerless-grinding machine is generally triangular and always a multiple of three.

Drafting Room Kink

By H. R. Bowman

When working on a drawing table where no shelves are available, the drawing instruments are usually spread all over the board, either out of reach or in the way of the T-square and triangles.

I made a portable shelf by fastening a piece of board to a block of wood as shown in the sketch herewith. The instruments are placed upon it and it can be moved to any position on the board on which the draftsman is working. An iron weight may be inserted to give stability but is not absolutely necessary. The thumbtacks on which it rests keep the wood from soiling the paper. If the table is slanting, the block may be cut at a corresponding angle so that the shelf will be level.



PORTABLE SHELF FOR DRAWING INSTRUMENTS

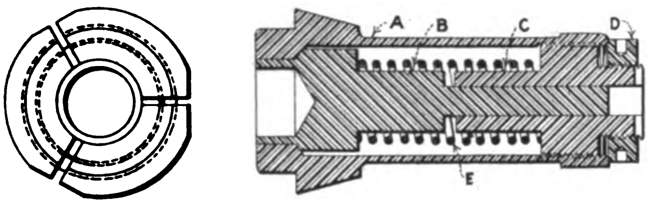
Finishing Spring Collet for Screw Machine

By I. Bernard Black

In the following article is described and illustrated a finishing spring collet designed for use in a No. 0, B. & S. automatic screw machine for finishing the inside diameter of gold rings after they had been blanked out by a punch press. In this particular design the spring collet takes rings from $\frac{1}{32}$ to $\frac{1}{8}$ in. in width. The outside diameter of the rings is 0.700 in. and the inside diameter when finished 0.550 inch.

A noval feature of this spring collet is the ejecting principle. The rings are fed into the spring collet by means of a magazine attached to the front cross-slide of the machine, and a push finger in the turret head. The machine is so set that when the inside diameter of the

ring has been finished by the tool in the turret head, the chucking mechanism will cause the collet sleeve (which is tapered and slides over the collet in the spindle) to draw back, thus opening the spring collet. The grip on the ring being released, the spring plunger *B* will eject the ring and so be ready to take the next ring fed to it by the magazine and turret. For each ring width, however, the spring collet has to be set, that



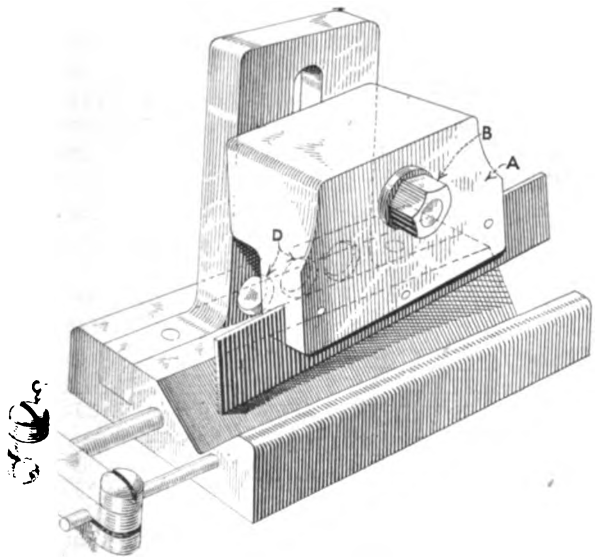
SPRING COLLET FOR HOLDING RINGS

is, the part *C* must either be screwed in or out and then locked in place by the part *D*, so that the distance between parts *B* and *C* will be the same as the ring width. In the illustration, part *A* is a standard single-angle spring collet for No. 0, B. & S. automatic screw machine and is made of tool steel, hardened and tempered. The part *B* is made of tool steel, hardened, and made a sliding fit in parts *A* and *C*. Part *C* is made of tool steel, hardened and has a slot machined on the end as shown to assist in adjusting. Part *D* is a nut made of tool steel and hardened. Part *E* is a steel spring made to suit.

Adjustable Taper Testing Fixture

By Edward J. Rantsch

The accompanying sketch shows an adjustable taper testing fixture in which the important points are: the three-point contact with the work, the adjustment covering a great range of sizes, and the adjustable gage



TAPER TESTING FIXTURE

which can be set at one end of the sample to be reproduced.

All that is necessary when setting the fixture to a given taper is to lay a taper gage or a sample of the taper to be gaged in the V-block, bring down the adjustable head *A* against the sample and secure it in position by tightening the nut *B*. Then the gage *C* should be brought against the end of the taper gage or sample, the taper of which is to be reproduced.

The fixture once adjusted, may be kept at the lathe where the taper is being turned and no time need be lost in going back and forth to try the taper in the spindle of the machine it is to fit. Neither will it be necessary to keep a valuable machine idle while a taper is being turned and fitted to its spindle.

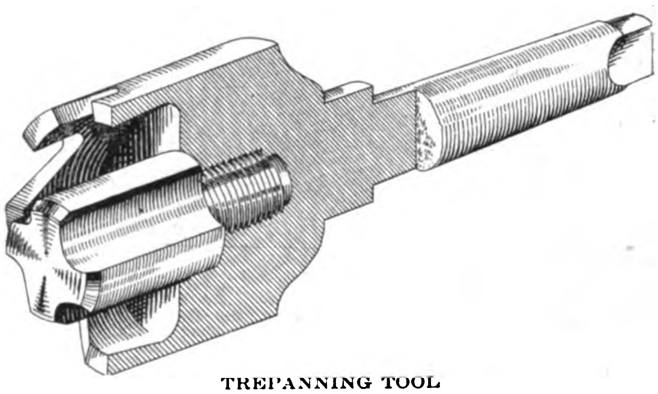
The holes *D* in the standard are for the purpose of letting in light, so as to see that the edge of the adjustable head makes proper contact with the sample or work.

Trepanning Tool for Flue Sheet

By Louis E. Reibel

In applying superheaters to locomotives it is necessary to change the flue sheets. In making the new sheets, the 4$\frac{21}{32}$-in. holes for the superheater flues were put in by first punching 1-in. holes, then enlarging them to 2$\frac{1}{2}$ in. by drilling and finally bringing them to size in a horizontal boring mill.

As the time required for doing the work in the above



TREPANNING TOOL

manner was excessive, I made the trepanning tool shown in the sketch herewith and its use reduced the time fully 70 per cent.

The tool is 4$\frac{1}{2}$ in. in diameter and has six cutting teeth, each $\frac{5}{16}$ in. thick. The 2-in. pilot is in the form of a reamer and is screwed into the shank of the tool as shown.

Limitation of Piston Aligning Gages —Discussion

By Charles G. Liendecker

Referring to page 659, Vol. 57, of the *American Machinist*, I note an article under the above title by J. T. Towlson, London, England. I have been experimenting with such a ball and socket piston head as described by Mr. Towlson for the last six months, having made up four pistons and tried them out in a Ford. I was under the impression that crystallization would take place where the ball joins the connecting rod.

I made one ball-connected piston and connecting rod complete about sixteen months ago and sent them to the Chandler Motor Car Co. for its engineers to pass judgment upon. They corroborated my opinion that the connecting rod would probably crystallize back of the ball. However, I determined to try out a piston and rod of such construction and they are still running and the ball and socket joint does not seem to be worn to any great extent. I have $\frac{1}{16}$ in. of laminations of 0.002 in. thickness between the bronze socket and

cap for adjustment, which a piston of the cross head-pin type does not have. Neither is there any way to take up wear on the present type of gas engine piston-head and pin.

It would seem as though the gas engine manufacturers, especially the makers of stationary gas engines, ought to look into this construction as it is a great improvement, as I know after seeing the many scored cylinders caused by the piston pins coming out against the walls. In my opinion, it is the proper connection for the piston and a connecting rod of a gas engine.

Special Hobbing Attachment

By O. S. Marshall

The special fixture here described is one recently devised and applied to a Gould & Eberhardt hobbing machine in the works of the Jones & Lamson Machine Company. Its purpose is for effecting an angular movement of the cutter-spindle head during cutting operation on certain jobs.

One particular job for which this attachment is used is a worm-wheel that is hobbed for both a right and a left hand worm, half the tooth-width being for right hand, and half for left hand. The worm for this wheel to be seen with the gear in Fig. 1 has right and left hand threads cut on opposite ends. When it is desired to shift from right to left hand feed or vice versa, the worm is moved longitudinally from one position to the other and held in either position by a controlling lever.

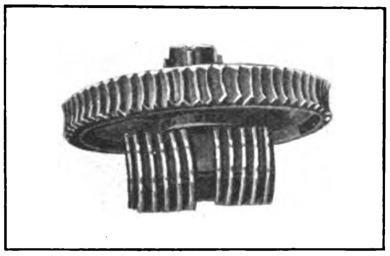


FIG. 1—RIGHT AND LEFT HAND WORM AND WHEEL

The production method for this worm-wheel had been to hob all the blanks in the lot with a hob of one hand and then run the lot through again, using a hob of the opposite hand in the second operation. A little experimenting revealed that both operations could be performed with the same hob without materially affecting the tooth-form and merely required rotating the cutter-spindle head angularly until the correct lead angle was obtained. The time was greatly reduced also. The machine could be set up for either a right or a left hand hob, the work, of course, rotating in accordance with the lead of the hob to be used. The cutting operation consists in feeding the blank into the hob the required depth in the regular manner. When the wheel has been hobbed to suit a worm having a lead in one direction, the cutter-spindle head is given the required angular movement to hob the wheel to suit a worm having a lead in the opposite direction. Both hobbings are done without stopping the machine or backing the work away until the two operations are completed, or both right and left tooth forms are cut.

The parts in Figs. 2 and 3 have the same reference letters. The worm-wheel segment *A* is attached to the cutter-spindle head, *B*, by means of supports as at *C* and so that its pitch line is coincident with the central pivot of the cutter-spindle head *B*. The worm *D* is carried by the housing-block *E*, firmly attached to the vertical slide *G*, which carries the cutter-spindle head. A stop, set in the segment *A* (in conjunction with adjustable stop screws), limits the amount of angular movement of the cutter-spindle head.

It will be observed that the worm-wheel segment *A* moves with the cutter-spindle head and is necessarily limited in the amount of possible travel, but this amount is sufficient for all ordinary uses. The worm is carefully seated to avoid backlash. The device is manipulated by means of the handwheel *H*, the proper amount of angular rotation being governed by adjustable stop-screws. It is necessary to free the clamping bolts of the cutter-spindle head slightly to permit its responding to the action of the worm, the practice being to leave one bolt at the top tightened during the in-feed, releasing it slightly while the operator manipulates the attachment.

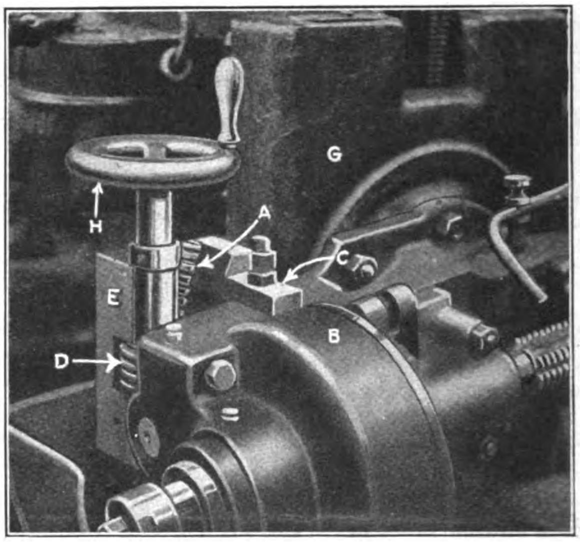


FIG. 2—THE ATTACHMENT ON THE MACHINE

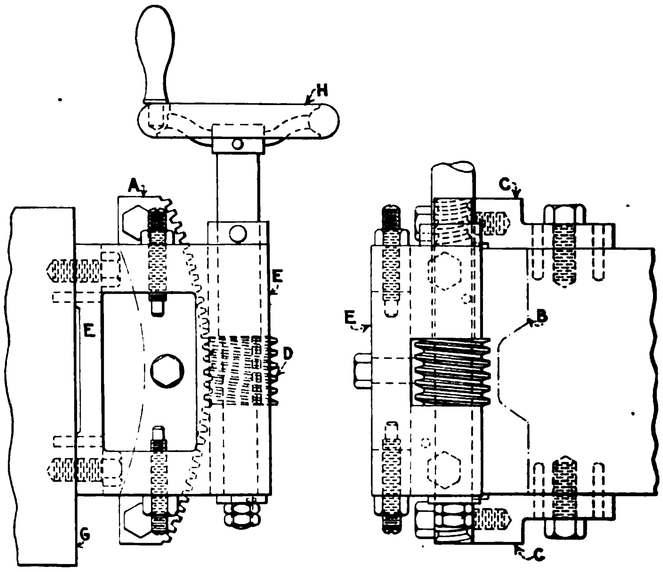


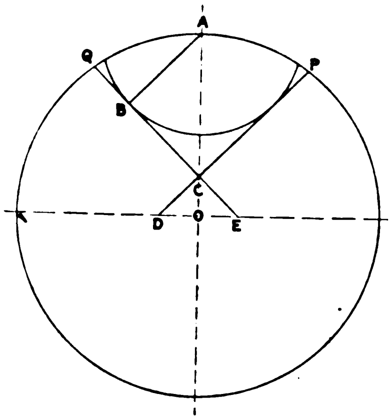
FIG. 3—DETAILS OF THE ATTACHMENT

The fixture has proved its value in repeated production jobs. When spiral gears of extreme angle come to the machine for generating, the attachment is removed. It can readily be attached or detached at any time and as the parts to be fitted to the machine are fitted with dowel pins, their proper location is easily determined.

A Problem in Shop Trigonometry

By M. Tolliver

The problem given and solved by J. Rantsch, which appeared on page 733 of *American Machinist*, is —. That's it. What is it? What does he want to find? When I went to school I was taught that the first step in solving a problem was stating it. So far I have not been able to find what Mr. Rantsch wanted to do, and not knowing this I am not able to say whether the solution fits it or not. Supposing, however, that he wants to cut the right-angle groove, and its outline must be marked off on the piece, it seems to me that he does a whole lot of things which might be left undone, and this is a sin second only to not doing the things which should be done.



A PROBLEM IN SHOP TRIGONOMETRY

If the problem is merely that of scribing the outline of the groove I would work it out as follows:

As $AB = \frac{15}{32}$ and the angle $ACB = 45$ deg., the line $AC = \frac{15}{32} \times 1.4142 = 0.663$. Subtracting this from the radius AO, we find

$$CO = 0.9375 - 0.663 = 0.2745$$

As OD and OE are both equal to OC, we can lay out the three points C, D and E and draw the lines DCP and ECQ, which winds up our problem.

A Large Repair Job in a Small Lathe

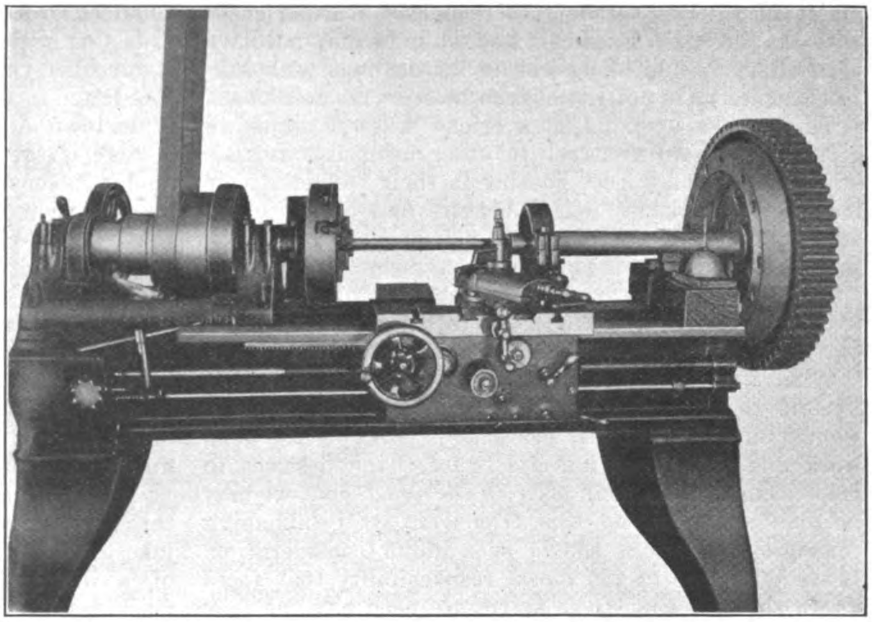
By George Wilson

The drum shaft, clutch, and gear from a hoisting engine were in the shop for repairs, having become damaged by an accident to the clutch mechanism. The repair involved the turning of a shoulder and cutting a new thread on the end of the shaft opposite the gear.

The first thought was, as a matter of course, to get the gear and clutch ring off so that the shaft could be placed between centers, but these parts were keyed very solidly in place and, as we learned that a similar shaft had been ruined beyond repair in an attempt to remove the gear, we changed our minds and decided to devise a way to do the work without taking the gear off. The illustrations show how the work was done.

There was an axial hole in the small end of the shaft about $\frac{7}{8}$ in. in diameter and 5 in. deep, and this circumstance aided us materially in the set-up. A bar of machine steel was first put on centers in the lathe and shouldered down at one end to a drive fit in this hole. The shaft was then placed in the lathe with the gear overhanging the bed—the tailstock having been removed for the purpose—the end of the extension caught in the lathe chuck and the weight of the gear supported by a large V-block carefully packed up to the right height.

The steady rest of the lathe furnished a support for the shaft close to where the cuts were being taken. We were thus able to complete the turning and threading almost as readily as if the gear had been removed.


LARGE REPAIR JOB IN SMALL LATHE

Locating Cutters in a Boring Bar

By William J. Thirkettle

Some time ago I had occasion to bore a number of holes in a rather awkward set of castings and the only machine available for the boring was a radial drilling machine. Owing to the peculiar shape of the castings, the position of the holes and the absence of several movements that would be found in any standard boring mill, it was necessary to leave the bar in place after a casting was set up until all the holes in that casting had been bored.

As it would have been difficult indeed to obtain a measurement of any kind to assist in resetting the cutters with the bar in place I was obliged to devise some way to return them to exact position after each resetting.

The cutters were round pieces of tool steel fitted to transverse holes in the bar and held in place by setscrews. In making up these cutters I first drilled and countersunk a conical cavity—like a center hole—in one side of each cutter midway of its length. Setting them in place with the cavities opposite the respective setscrew holes in the bar, I dropped a small steel ball in each and followed it with a cup-pointed screw.

Thus held, I put the bar on centers in a lathe, turned the cutters to their respective diameters, removed and hardened them and returned them to place for grinding and relieving. I could now take out the cutters at any time for sharpening and return them to their respective places with assurance that the little ball would locate them accurately to cut the correct diameters.

Boring bars, fitted with interchangeable cutters as described in the preceding paragraphs, will always be found useful in shops where much boring is to be done.

Editorial

THE OLD IDEA of putting all the best furniture in the parlor, protecting it with slip covers and locking the door to open it only in case of a funeral, is pretty nearly obsolete at this date. But to buy nice machinery and then pamper it for fear it may wear out is still quite common. What is the good of chairs except to sit on them, and what is the use of machinery except to produce with it?

The Honor and Responsibility of Being an American

AT THE TIME of year when sentiment is uppermost in the hearts of men it is a gratifying feeling to know that you are respected, trusted and loved by some at least of the people in this unhappy world. One of the best features of this feeling of gratification is that it stimulates one to be worthy of the gratitude and to strive to earn more of it. There is also a responsibility to remain true to the ideals that have led one on which has a sobering influence.

We have recently had the pleasure of hearing from an American Relief Association officer what the Russian thinks of the American, from an eminent mining engineer formerly employed by the Turkish government what the Turk thinks of the American, from a Chinese merchant and from an American worker in a Chinese school what the Chinese thinks of the American, and from the secretary of the A.S.M.E. what the South American thinks of the North American engineer.

In Russia, we learn, the A.R.A. has not only filled the stomachs of the people and broken the famine but has helped these desperate people to regain their grip. They look on Americans as a people apart, a people to be trusted and to be emulated.

To the Turk we appear as the only Christian nation that does not have a feverish desire to exploit him or his country. He has had rather unpleasant experiences with his European neighbors and while he may not have been all that could be desired in his dealings with subject peoples he is not worse than most of the rest of us.

China looks upon us as a friend without an ax to grind, a pleasant contrast to other ostensible friends with concessionary bees buzzing in their bonnets. Our medical missionaries, our educators and our financial advisers have paved the way for friendship which the square dealing of our statesmen has helped to confirm.

The South Americans are sending more of their boys to the United States each year to learn something of our ideals of integrity, efficiency and right living.

What a grave responsibility rests on our shoulders to live up to this admiration and respect. But what a wonderful opportunity it presents to carry on the good work and help those less fortunate than ourselves to help themselves to their place in the sun. That we may be able to realize on this friendship by establishing commercial relations should be a minor consideration. If we take care of the moral responsibility that faces us, in the true Christmas spirit, we need have no fear that our reward will not come along in due course.

Ship Subsidy Bill Threatened by Dog-in-the-Manger Opposition

A REGRETTABLE SPIRIT of envy, a mean dog-in-the-manger attitude, has been responsible lately for holding back the fulfillment of many worth-while projects. There was a time when success and progress in men and nations was a matter of admiration. So long as their prosperity was not secured at the expense of others it was considered commendable.

But recently there has been a change of face. It has reached its most absurd expression in the opposition to the Ship Subsidy Bill. The argument is not that the United States will suffer loss of money or prestige because of its enactment, nor that other nations will suffer, but that certain individuals may benefit.

It is not claimed that the country will lose, but the fact that some people may gain—legitimately—rankles in the minds of the envious. The knowledge that their stubbornness may work havoc to the country means nothing to them.

A certain amount of perversity and blindness on any large issue is to be expected, but when a bushel of coin is refused because some one else may get a grain or two, it is time to do something strenuous. There is little doubt that the United States will benefit by the bill. Then by all means consider the good of the nation! If certain individuals also benefit, so much the better.

It Pays to Keep Up With the Procession

A RECENT BULLETIN from the general manager of the National Machine Tool Builders' Association called attention to a situation that has serious possibilities. It has to do with the standardization movement.

The bulletin discusses a communication from the Chief of Ordnance to the American Engineering Standards Committee recommending that steps be taken to standardize certain machine tool parts and accessories. The letter incloses a list of standards as adopted at the Watertown Arsenal.

Here is the point. If the builders of machine tools do not take an active interest in standardization and present their side of the case in committee meetings that may be called, it is a certainty that the big users will go ahead without them and lay down certain specifications that may be embarrassing to meet.

Another possibility is that the users of machine tools in various important industries may not be able to get together but may go ahead on independent lines, each establishing standards of its own that differ from those of all the rest. For instance, the General Electric Co. might decide that T-slots of certain dimensions should be used on all milling machines of a certain size throughout its several plants. General Motors might take a similar position and say that a standard T-slot of a different size should be used on the milling machines in the Cadillac, Buick, Oldsmobile, Oakland and Chevrolet plants. The Singer Mfg. Co. might es-

tablish still a third standard for its Bridgeport, Elizabethport and South Bend shops. Any one or all three of these standards might require extensive re-designing and re-tooling on the part of every machine tool builder who wanted to bid for business from these companies. And all because the builder refused to sit in and meet the ideas of the customer half-way.

It is a footless argument to contend that the customer must take what the manufacturer chooses to offer him. In the first place there would probably be some manufacturer hungry enough for the business of such big houses to build a product to meet their specifications. In the second place organizations like the ones mentioned could build their own tools to their own standards if they had to. The extra cost would be counterbalanced by the savings due to the standardization of small tools thus made possible.

As a matter of fact the question never would have come up at all if the builders had got together and established standards of their own for the work and tool holding elements of their machines. In that case the users could have used one expensive cutter on each of several milling machines of different makes as the occasion arose, instead of being forced to buy a different cutter for each machine.

All this is very unpleasant to think about and quite unnecessary if the men concerned will only recognize that a real procession has started and go with it. It is a procession that will lead to economic and scientific improvement for every one. Why not join in and help a good thing along?

Vindication of Langley's Airplane Design

TWENTY-SIX years ago Prof. Langley made the second successful flight with his steam driven "aerodrome" model which flew for nearly two minutes and covered about three-quarters of a mile. The trial of the full sized machine in 1903 and its failure due to the landing device, stopped the funds from the War Department and experiments ceased. Three years later Prof. Langley died, largely as the result of hostile criticism and ridicule at this failure.

Yet, perhaps more than anyone else, Langley had worked out the correct theory for planes. His critics and defamers who are still alive must be chagrined to find that the winning glider in the recent competition in England, built by Peyret, is very similar to the monoplane designed by Langley and is credited to him by Peyret himself.

It is to be regretted that Prof. Langley could not have lived to see the airplane of today and to see his own machine flown by Glenn Curtiss in 1914 with its original engine (built largely by Manly), even with the addition of 300 pounds of weight in the shape of pontoons.

All this goes to show how thoroughly American the airplane really is and should inspire us all to aid in its development in the country of its inception. It has long since passed the experimental stage—it now needs to be encouraged by the establishment of landing fields in every city and town and by its use for commercial purposes whenever possible. The growth of the aircraft industry depends largely on popular interest in aviation and each one can help in his own community.

Airplanes are mechanical devices and require machine tools and machinists for their construction and maintenance.

The Trend Toward Simple Machines

THERE SEEMS to be little doubt that the demand, we might almost say craze, for strictly single-purpose machine tools is decidedly on the wane. Just how much of it was justified and how much was a total economic waste, we shall never know. But it is good to know that we are getting back on a more rational basis.

There is, however, a decided tendency on the part of large users of machine tools, such as the automobile builders, to demand *simple* machine tools. Not for machining a single piece, but to perform a simple operation, such as gear cutting, on a simple machine.

Taking gear cutting as an example we find this simplification being forced on the builders instead of being inaugurated by them. The demand for quiet gears in automobile transmissions has led to exhaustive study and experiment in the endeavor to secure gears which are concentric and with correct spacing and tooth form. It has been shown that gears vary slightly from time to time on the same machine. This has been traced in some cases to slight defects in the gears in the machine itself.

Realizing more and more the impossibility of securing perfection in gearing one of the large motor companies built a gear-cutting machine with only four gears in the whole machine. The bearings are large and rigid and the whole machine is as free from spring and vibration as they could possibly make it. It is not a universal machine but it will handle such gears as are found in automobile transmissions, and is not in any sense a single piece machine. The four gears in the machine are made as accurately as possible and the results have been very gratifying. The four gears replace from twenty-seven to thirty-five gears in the commercial machines, these being used to give the machine a wider range of work.

The automobile builder in question has no desire to go into the building of machine tools, and has commissioned several builders of gear-cutting machines to build machines of this simple design. The simplification of machine tools for manufacturing shops is a step in the right direction. There will, of course, always be a demand for a more universal machine for shops doing work in smaller quantities. But the eliminations of gears and bearings must have an effect on securing more accurate work and the first cost of the machine may be somewhat lower.

Just Suppose

JUST suppose that you hired a staff of engineers to travel about the country—or even abroad occasionally—so that they could study the latest methods of doing machine work in the most economical manner.

Suppose they sent you a weekly report, illustrated with photographs or drawings that showed just how the other fellow did it? You'd be pretty sure to find some interesting and valuable information in these reports, information that would save you dollars and dollars every year.

Just suppose you let these reports stay unopened on your desk as you sometimes do copies of the best technical papers, because you thought you didn't have time to read them. *You* probably don't neglect any opportunity to secure new and worth while data, but—

Just suppose.

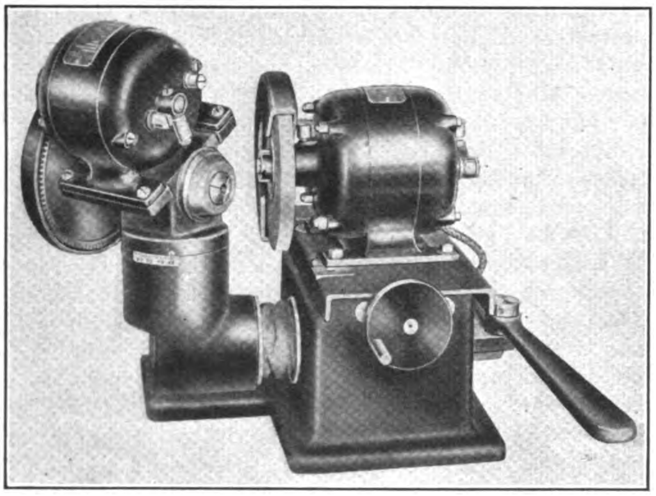
Shop Equipment News

Fleming Valve and Reamer Grinding Machine

The Fleming Machine Co., Springfield, Mass., has placed upon the market the electrically driven machine herewith illustrated for grinding the valves of automotive engines, and also for grinding the valve seating reamers used in connection with them. The device needs but to be connected with any convenient lamp socket to be ready for service.

A ⅛-hp. ball-bearing motor, mounted upon a slide rest that has screw-adjusted movement in one direction and a hand-lever-operated movement in the other, drives a 6-in. diameter, ⅜-in. face grinding wheel at a peripheral speed of 5,200 ft. per minute. A 1/20-hp. motor upon the swiveling work head drives the work spindle through speed-reduction gearing. The work is held in spring collets having a maximum capacity of ¾ in. round.

The swivelling work head adapts the device to grind



FLEMING VALVE GRINDING MACHINE

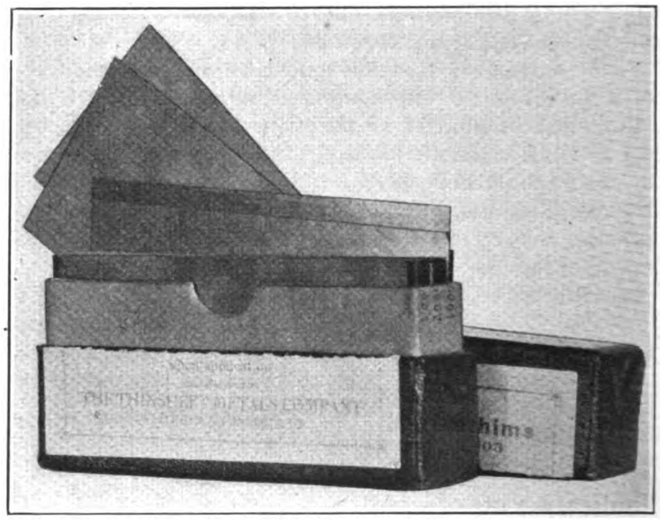
any angle with which the valves of commercial engines are made, and it is easily and quickly adjusted to the desired angle by means of a sector graduated in degrees. Valve seating reamers and the corresponding valves may be ground without disturbing the setting, so that the correct seating of the valve is assured.

Boxed for shipment the device weighs approximately 100 pounds.

Thinsheet Brass Shims

In order to provide the utmost in convenience and economy where small brass shims are required, the Thinsheet Metals Co., Waterbury, Conn., has just placed on the market boxes of brass shims such as illustrated herewith. Each box contains 150 sheets 2 x 4 in. in size, with three thicknesses of 0.001, 0.002 and 0.003 in. The different sizes are kept separate in the box, so that they can be easily reached. The size of the box makes it suitable for use both at the bench or in a tool kit to be carried to the job.

The small sheets are more convenient to use than where it is necessary to cut shims from a large sheet. The waste is reduced, it is stated, as this factor is very often large when shims are cut from a sheet, even

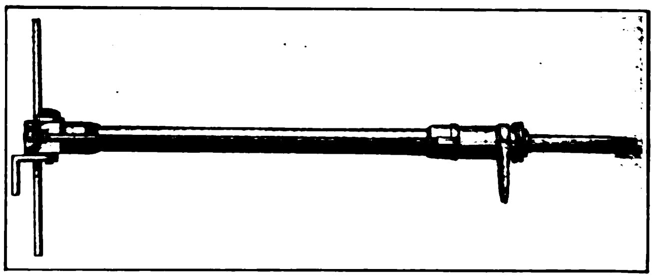


THINSHEET BRASS SHIMS

though care be taken. Strip metal, although economical to use, is not always convenient for the reason that rolls of brass of various thickness are not generally available at each bench and cannot well be carried to repair jobs away from the shop.

"Boyer Superior" Pneumatic Rivet Cutter

Working on the principle that when cutting rivets, a number of comparatively light, rapid blows cause more vibration and therefore more distortion of steel plates than a few intermittent, heavy blows, the Chicago Pneumatic Tool Co., New York, N. Y., has recently designed and placed on the market a type of pneumatically



"BOYER SUPERIOR" PNEUMATIC RIVET CUTTER

operated rivet cutter designated as the "Boyer Superior."

The construction of the device is shown in the accompanying illustration. The tool consists of a dead handle for holding the machine, a throttle handle of the crank design, a throttle valve of the taper type, a back head

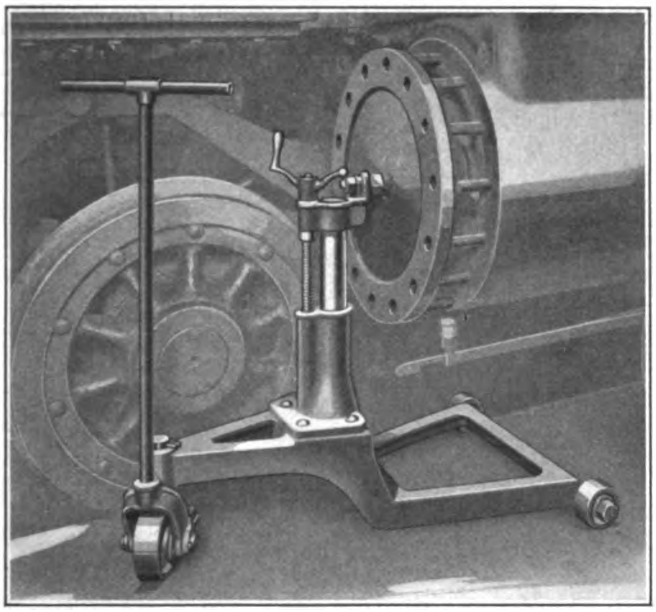
screwed onto the cylinder and secured by a locking device, a cushion chamber in the rear end of the cylinder, a cylinder of seamless steel tubing, a bypass from back to front head, a non-removable electrically welded front head, square coiled spring buffer, adjustable chisel lock, hand hold of the spade handle type, and a chisel.

To operate the cutter, the throttle handle is moved in a line parallel with the cylinder. Each forward and return stroke of the piston is hand controlled. About four blows, requiring approximately 10 to 15 sec., are said to be required to cut off the head of a ¾-in. rivet. Two men are needed to operate the machine.

"Viloco" Portable Cylinder-Head Crane

A portable crane or truck for use in the removal and replacement of locomotive cylinder heads and crossheads has recently been placed on the market by Harry Vissering & Co., Chicago and Benton Harbor, Ill., under the trade name of "Viloco." The accompanying illustration shows the device, which is suitable for all classes of locomotives and can be employed for moving the cylinder head to any part of the shop desired.

The frame of the truck, which provides a center distance of 32¼ in. between the front and the rear wheels and of 21 in. between the two rear wheels, carries a vertical steel column to which the cylinder heads can be



"VILOCO" PORTABLE CYLINDER-HEAD CRANE

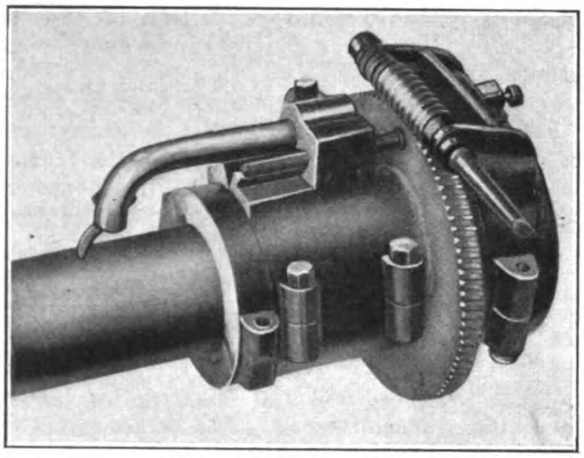
secured. The column is 2⅜ in. in diameter, and can be adjusted by means of a screw having a pitch of 7 threads per inch. By means of the lever at the top of the column, the screw can be turned to vary the height of the head, the maximum height of the bolt carrying the work being 36 in. above the floor.

The handle for pulling and steering the truck is made of pipe and is connected to the front wheel in such a manner that the weight of the truck keeps the handle in a vertical position when the truck is not being pulled. Lowering the handle causes a slight raising of the truck frame, so that a quick adjustment of the height of the work can be easily obtained. The advantage of this construction is that the cylinder head can be easily raised or lowered to the level required to clear the studs when placing it on the cylinder.

Device for Truing Journals on Locomotive Axles

C. E. Marsh, 324 Hemphill Ave., Atlanta, Ga., has recently brought out the device for truing journals on locomotive axles shown in the accompanying illustration.

The device, including the worm wheel, is made in halves so it can be clamped about the axle. At one



MARSH'S AXLE TRUING DEVICE

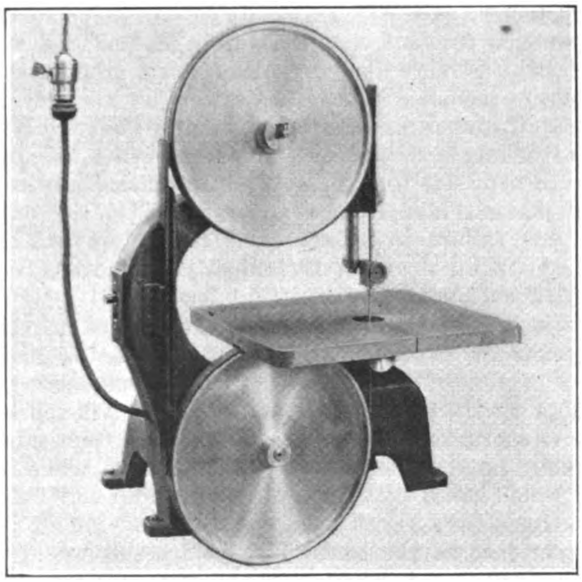
end of the worm shaft is a standard taper shank by which the device may be driven from an air drill or electric motor fitted with a taper socket.

The cutting tool is inserted in the tool arm as shown and may be made of any kind of steel or of any shape desired. The block carrying the tool arm is fitted to a dovetail slide and the feed is by a screw. Three changes of feed in either direction are provided.

The device is portable and its use obviates the necessity of swinging an axle with its wheels into a driving wheel lathe to true the journals.

Jarvis Electric Bench Band Sawing Machine

The accompanying illustration shows an electric-driven band sawing machine for general use such as encountered in a pattern shop, that is being manufac-



JARVIS ELECTRIC BENCH BAND SAWING MACHINE

tured by Benjamin E. Jarvis, Inc., Newark, N. J. The machine is intended for bench mounting. It is of a portable type that can be installed by attaching to any lamp socket, thus eliminating the necessity of countershafts and belting.

The saw bands are of a flexible, Swedish steel of a nature to resist crystallization. The wheels are 12 in. in diameter, 1-in. face, made of steel and mounted on ball bearings. The upper and lower guides are of the roller type and the rolls revolve on hardened centers. The capacity of the machine is for 2-in. wood, either hard or soft. Saw bands can be supplied for cutting thin brass and soft metals.

Current for driving the ¼-hp. motor may be supplied from a lighting circuit. The motor is controlled by means of a pushbutton switch located on the frame of the machine. The table is 13½ x 15 in. in size and may be tilted to any angle. The machine is 28 in. high and weighs 120 pounds.

Selling Machine Tools

By Albert Clegg

What are the most essential qualities for the successful selling of machine tools? Is a knowledge of men more desirable than a knowledge of things? In other words, is the jolly good fellow with the pleasing and agreeable personality but with very little technical knowledge likely to make a more successful salesman than the chap who knows the subject from A to Z, but who has not had either the time or the inclination to develop the social side of his being?

We all know that the man who combines a thorough knowledge of his goods with a sound study of human nature and psychology is the man most likely to get there. He is quite ready to agree, when out to sell us something, that our Ford is equal to a Rolls-Royce, that our local football team is almost sure to win the cup, and so on, until we begin to believe that after all our judgment must be sound.

From the salesman's point of view, the study of human nature is all too often a study as to how to sell something to a man who doesn't want it, and who, when he gets it, frequently does not and cannot make the best use of it. Someone has said that the best salesman is a combination of satisfactory product and satisfied customer.

From this point of view the purely psychologist type of salesman is more likely to come a nasty cropper than the purely technical type. The latter, by his very ignorance of human nature, would be protected from the risk of selling a machine or appliance which the purchaser had no use for; in fact, his technical knowledge would prevent him from even trying. On the other hand, his failure to be agreeable might prevent him from convincing a prospective client that he was losing money by not purchasing a certain machine.

The technician is more likely to err by sins of omission, while the psychologist will usually suffer from the results of sins of commission. One will sell more and give less satisfaction per sale and the other will sell less and give more satisfaction per sale. The former might eventually build up a business or connection while the latter would run a grave risk of losing an already established connection. Both men would be learning by bitter experience all the time. The final result would resolve itself into a question as to which man could learn his business the sooner. Is the study of human nature more difficult than the study of machine tool construction, design and operation?

What, then, are the basic principles of salesmanship as particularly applied to machine tools? In the first place it is to establish some definite, sentient connection between the prospective user and the manufacturer with a view to effecting a deal that will be to the mutual benefit of the two parties. Note the word *mutual*; the day is gone by when one confers a favor by purchasing from another. Second, salesmanship should assist the manufacturer in keeping abreast, or ahead, of the times, by indicating the lines successful competitors are following. Third, salesmanship should concern itself with striving to achieve the very widest publicity for the goods.

The day is past when machine tools can be sold by making wild and extravagant statements as to what they can do. An incident which occurred some years ago will serve to illustrate the dangers of such a course. A representative of one of the biggest merchants in the country called on one of his customers to discuss an inquiry for a cutter grinder. The merchant handled one of the leading American makes of cutter grinder, a machine that was almost, but not quite, universal in its capacity. The customer wanted the machine for general cutter grinding work but particularly for a certain special job that was rather outside the usual scope of such a machine. When the representative called he was asked if the machine offered by his firm would be suitable for the special work. In reply he gave a long dissertation as to the capabilities of the machine on every class of cutter grinding and wound up by suggesting that the machine would play the Halleluiah chorus if set up properly. On the strength of his assertions and assurance, the order was placed, the total value being something under £100. Now for the sequel. While the machine was a good one in every way and quite satisfactory on all the ordinary classes of cutter grinding, it was an absolute failure on the job for which it had been particularly bought, and no amount of argument could convince the customer that it was at all suitable. The machine was finally taken back and the representative, by bitter experience, was taught never to make extravagant claims for his machine. For years afterward neither the representative nor his firm sold a penny's worth to the disappointed customer, the loss involved amounting to thousands a year.

To return to our original query, is a knowledge of men more desirable than a knowledge of things? Would we as business men be more likely to give an order to a nice, agreeable sort of chap who knew very little about the subject, than to a directly opposite type of man who knew the whole business thoroughly and could discuss all the pros and cons relating thereto? Of course we all like to meet the smart, incisive fellow, whose personality is such a refreshing tonic in the ordinary, everyday routine of business, but nevertheless very few of us would be prepared to admit (even to ourselves) that our decisions had in any way been influenced by the man's personality alone. In selling machine tools the object is to prove that the tools offered will pay a good return and be entirely satisfactory in the prospective client's works, and the only man qualified to judge that is the one who is thoroughly grounded in the operation of the machine. His personality merely enables him to present his argument in the most agreeable manner, and if he is lacking in a knowledge of the subject his arguments will carry very little weight.

News Section

Air-Cooled Motor Meeting of S.A.E.

The Metropolitan Section of the S. A. E. held its December meeting at the Automobile Club of America on the 14th. The paper was on Air-Cooled Motors by Charles Grimes, research engineer of the H. H. Franklin Co., in which he gave the results of their twenty two years of experience with air cooling. An interesting feature of the paper, and one which shows the broad policy of the Franklin Company, was the pains taken to point out the details to avoid in building a successful motor. The results of their years of experience were laid bare for the benefit of any builder who may be working toward air cooling, and there are many. This is in such marked contrast to the older and, we believe short sighted policy more prevalent in other lines, that it stands out as a shining example of co-operation.

The paper was very complete and showed great care in the development of both the mechanical and the combustion features of the new motor. The small amount of power consumed in cooling was rather astonishing to many and the care with which the details have been worked out is of unusual interest. There was some discussion and numerous questions, all of which were answered very satisfactorily.

Power Exposition Very Successful

The National Exposition of Power and Mechanical Engineering, following as it did the forty-third annual meeting of the American Society of Mechanical Engineers, attracted a large number of engineers from all parts of the country. It was held in the Grand Central Palace, New York, N. Y., from December 7 to 13.

Although there were some exhibits by machine tool and engine builders, the majority of the displays were devoted to equipment for boiler room and power plant use. Firebrick, condenser, stoker, tank, boiler tube and such manufacturers had large exhibits, of a heavy nature in many cases. Valves, meters and a variety of measuring and recording instruments were shown in considerable numbers. The scope of the exposition is attested by the fact that there were about 150 exhibitors. Full size units and working models served to show the practicability of the products exhibited, and added life and interest to the exposition.

A.E.S.C. to Study Steel Numbering Problem

After extended discussion of the problem involved in the numbering of steels, the conference called by the American Engineering Standards Committee, at the request of the Bureau of Standards, decided the matter could be handled better by a sectional committee of the American Engineering Standards Committee. For that reason no plan or program was adopted so that the sectional committee could consider the matter without limitations as to whether the classification be based on chemical analysis, heat treatment or physical tests.

Machinery Exports Show Slight Decrease

Exports of metal-working machinery during October were slightly less than in September although considerably above the value of the exports in October, 1921. October exports were valued at $902,188, as compared with $1,093,381 in September of this year and $1,032,483 in August. The detailed figures, of the Bureau of Foreign and Domestic Commerce, are as follows:

EXPORTS METAL-WORKING MACHINERY

	September 1922	October 1922
Lathes	$54,874	$57,161
Boring and drilling machines	40,628	34,262
Planers, sharpeners and slotters	15,758	38,256
Bending and power presses	11,085	7,179
Gear cutters	14,667	983
Milling Machines	29,662	69,389
Sawing machines	5,041	1,800
Thread cutting and screw machines	22,924	7,464
Punching and shearing machines	7,171	14,977
Power hammers	20,886	10,386
Rolling machines	3,897	786
Wire-drawing machines	81	935
Polishing and burnishing machines	1,265	1,248
Sharpening and grinding machines	56,468	78,044
Chucks, centering; lathe, drill and other	18,676	19,102
Reamers, cutters, drills and other parts for machine tools	114,475	121,944
Pneumatic portable tools	35,389	26,550
Foundry and moulding machinery	44,436	41,314
Other metal-working machinery and parts of	596,508	370,408
Total metal-working machinery	$1,093,381	$902,188

Navy Funds Increased

The Navy appropriation bill reported to the House last week carried appropriations totaling approximately $53,-000,000 for continuing construction work on the ships permitted to be completed under the five-power treaty.

This is an increase of $12,000,000 in round numbers over the estimates submitted in the budget, which provided for $29,000,000 in cash and $12,000,000 in indirect appropriations. The increase made by the Appropriations Committee mainly is in the indirect allowances.

Foreign Trade Convention

The Tenth National Foreign Trade Convention of the National Foreign Trade Council will be held in New Orleans on April 25, 26, 27, 1923, according to announcement made last week by O. K. Davis, secretary of the council, India House, New York City.

Domestic Business Shows Further Improvement

Further improvement in the general business situation is shown by November figures so far received by the Department of Commerce. Marked increases have again occurred in the production of pig iron and steel making the output of these industries much the largest for any month in two years. Unfilled orders of the Steel Corporation declined slightly, but this may be due in part to better transportation, which has made it possible to catch up on deliveries. Building contracts in November totaled $248,000,000, or only $5,-000,000 less than in October and 30 per cent above November, 1921. Further increases in employment have taken place. The U. S. Employment Service reports that expansion in employment throughout the country has been the greatest since January.

Provides for Increase in Naval Aircraft

A bill, authorizing the Secretary of the Navy, during the fiscal year 1924, to procure, purchase, manufacture, or construct additional aircraft as may be required for the Naval Establishment, including the necessary spare parts and equipment therefor, at a total cost not exceeding $5,798,950, has just been introduced in the House and referred to the Committee on Naval Affairs.

Willard Defends Esch-Cummins Law

To keep the Esch-Cummins Transportation law intact would be the best policy for the Government to pursue with respect to the railroads, according to Daniel Willard, President of the Baltimore & Ohio Railroad, who spoke last week at a luncheon of the Advertising Club, 47 East Twenty-fifth Street.

Although the roads are not yet earning what Mr. Willard considers a fair return on the value of their property, he is confident that a gradual reduction of freight rates may be looked for, providing the Federal rail law in its present form gets a fair and sympathetic trial.

British Industries Fair

The Board of Trade of Great Britain issued during the past week a booklet on the forthcoming British Industries Fair which is to take place concurrently in London and Birmingham from February 19 to March 2, 1923.

The Fair, it is announced, is not an exhibition but essentially a trade fair to which only buyers will be admitted, Americans desiring to attend the Fair, while visiting England, may obtain tickets of admission on application to the British Consulate General, 37 West Van Buren St., Chicago, Ill.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Director, *Commerce and Finance*, New York

THE advance in sterling exchange and the growing shortage of labor are the two most important developments of the week. Bills on London sold at 4.69 last Wednesday and although the market reacted somewhat and stands at 4.65 as this is written it is plain that the masterful financiers of the British Empire are determined to provide the merchants of the realm with a medium of exchange that is as good as the best.

Although it is variously explained, the immediate cause of the advance is not apparent, but it is fundamentally due to the exhibition of financial courage that the English government has given in handling its debt to our government as well as its persistence in attempting to untangle the reparation snarl in which France and Germany are involved.

Mr. Morgan's call upon Secretary Hughes, the ensuing talk of a loan of 1½ billion dollars to Germany, and a statement from the White House indicating that the President would be glad to find a way to aid Europe in settling her economic problems, have also helped the market for foreign exchange. Francs have advanced sharply and even German marks are up to 145 despite the latest statement of the Reichsbank which shows a total of over 753 billion paper marks outstanding as of Nov. 20.

The effect of the advance in exchange has been to lift commodities like wheat and cotton whose value is largely determined by the price obtained for our exportable surplus, but as sterling is now within 4 or 5 per cent of par there is not much room for a further rise and it is quite possible that the Bank of England will soon attempt to strengthen its position by taking gold from us in quantity, even at a small loss.

Should any such movement develop it is almost certain our commodity markets would be chilled, for the analysis published weekly by the Federal Reserve Board shows that the total of the loans, discounts and security holdings of the 784 more important member banks on November 29 was 416 millions greater than on May 25, 1921, when liquidation was being insisted upon as essential. Since that date the gold held by the Federal Reserve Banks (which gained nearly $15,000,000 last week) has increased by over 669 millions, while the Federal Reserves notes in circulation have decreased some 483 millions. The result is that the reserve ratio has risen from 56.8 per cent to 75.1 per cent, but all this would be speedily changed if we commenced to export gold in important amounts.

Our dependence upon a continued abundance of credit for the moderate degree of business activity and prosperity now reported, and in some cases exaggerated, is also emphasized by the labor shortage.

The Department of Labor says that the shortage is acute and this statement is confirmed by employers all over the country. The scarcity is attributed to the restrictions upon immigration. One result of it has been an abnormal exodus from the farms to the cities. The negroes are leaving the South in such numbers that organized efforts to check the hegira are being made in some states, but the railroad passenger agents report that the movement continues nevertheless.

Wages in many industries are already advancing as an inevitable consequence of the competition for labor and the sequence is certain to be a decreased production at an increased cost. This may for a time create an illusion of good times but it will limit consumption, tie up credit and must ultimately restrict activity. The existing railway congestion adds to the difficulties of a difficult situation.

In a recent address President Markham of the Illinois Central Railroad pointed out that in the five years ending with June 30, 1907, the number of freight cars in service increased more than 480,000. In the next five years it increased less than 230,000; in the next four and a half years it increased only 114,000, and in the five years ended with 1921 the number of freight cars in service actually declined more than 13,000.

During the same period the number of locomotives in service varied as follows:

5 years ending June 30, 1907	increased	18,160
5 years ending June 30, 1912	increased	8,447
4½ years ending Dec. 31, 1916	increased	4,558
5 years ending Dec. 31, 1921	decreased	664

These figures explain the present inability of the railroads to handle the traffic that is the economic life blood of the nation. They make it clear that a business boom is impossible because an abnormal increase in distributive trade would be almost certain to result in strangulation and until our railway facilities are increased the check rein of inadequate transportation will probably continue to hold us back.

A year ago when trade was subnormal and well below the capacity of our facilities for production and distribution it was safe to predict an improvement, but the shortage of both labor and transportation seems to make any further expansion presently impossible and this view of the case suggests caution in accepting the many highly optimistic predictions that are now being made.

A mild prosperity is indicated, but no wild outburst of speculation and advancing prices appears to be possible. The Christmas trade is good. The postal receipts swelled by the increased use of the parcels post show a gain of about 20 per cent. The steel mills are fairly busy and copper is at last a little above 14 cents. Sugar is slightly easier as the weight of the new and abundant Cuban crop commences to be felt, and cotton and wheat are somewhat higher because of the advance in foreign exchange as already explained.

The stock market is steadier. The fear of political radicalism appears to be at least temporarily allayed. The year-end selling to reduce income taxes is nearly finished and the reinvestment demand has absorbed several large issues of new bonds.

The purchase of the International & Great Northern by the St. Louis & San Francisco Railway has attracted not a little attention as foreshadowing other transactions of the same character that are inevitable if the consolidations provided for in the Esch-Cummins bill are to become realities. Inasmuch as it is only through such consolidations or government ownership that it will be possible to rehabilitate our transportation service and as either alternative is almost certain to increase the value of railway securities I continue to believe that the greatest bargains of the investment market are to be found among them.

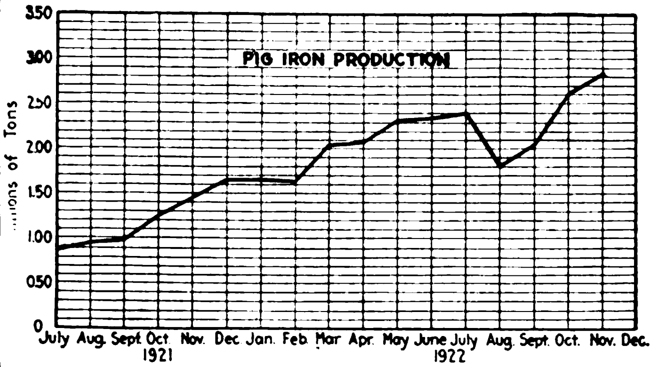
Southern Industries See Prosperity Ahead

A thorough investigation of general conditions prevalent in the metal trades industries over the South, conducted the fore part of this month by William E. Dunn, Jr., secretary of the Southern Metal Trades Association, shows the industry to be in better shape than it has been at any time within the past three years, with every promise that 1923 will prove a prosperous year. Most manufacturers seem to be expecting an inflation period similar to that of 1918 and 1919, but look for it to be on a more stable basis and not followed by so long a period of depression, if any at all.

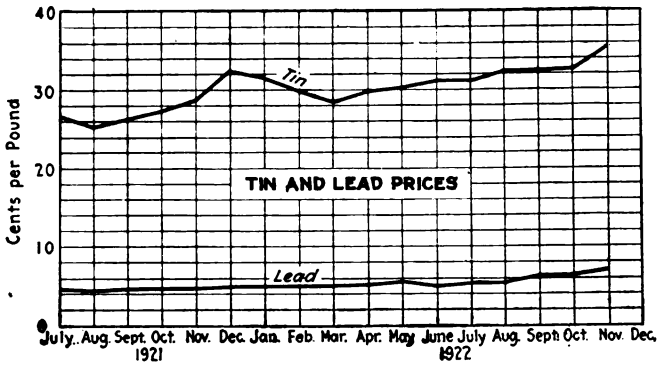
More furnaces, foundries and machine shops are operating in the South now than at any time in several months, and a majority of them are well sold ahead into 1923. The pig iron melt in the whole district, principally in Alabama, is at the highest mark since the flush times during the War. The usual Christmas holiday will, for the most part, be confined to a day or two this year because of the rush of business.

The association advises pig iron quotations for the first quarter of 1923 as somewhat weak, the price on some sales being as low as $23 for No. 2 foundry, with heavier tonnages selling in some cases for as low as $22.50. The prevailing price, however, appears to be around $25 with inquiries very numerous from substantial buyers.

Monthly pig iron production of all coke and anthracite furnaces in millions of tons, based on returns compiled by the American Iron and Steel Institute.



Monthly average price of tin and lead in the New York market, based on returns furnished by Engineering and Mining Journal-Press.



PIG iron production registered another advance in November over the month previous, although the increase was not so marked as in the case of the October output as compared with that of September. Coke and anthracite pig iron tonnage during the month totaled 2,849,703 tons or an average of 94,990 tons per day as against the October total of 2,637,844 or 85,092 tons per day. November, 1920, output totaled 2,934,908 tons or 97,830 per day. The number of blast furnaces in operation increased during the month 242 being in blast on Dec. 1 as against 218 on Nov. 1.

Tin and lead prices were stronger and higher during the month. The average November price for the former was 35.911 cents as against 33.935 in October, while lead reached 7.047 cents, an increase of over a half cent during the thirty-day period. While the demand for both metals for home and foreign consumption has not been of an active nature, a better tone has been in evidence with excellent prospects for a strong market during the first quarter of the coming year.

Automobile share markets declined slightly during the month, ten representative issues showing an average price of $44.20 per share as against the October average of $46.52. No special significance is attached to the decline, the entire New York market showing a softening of prices with but little interest and that chiefly of a professional character in evidence. Automobile production continues heavy with an excellent demand for closed cars and a shortage of bodies.

Comparative Prices of Shop Supplies

Average of New York, Chicago and Cleveland Prices

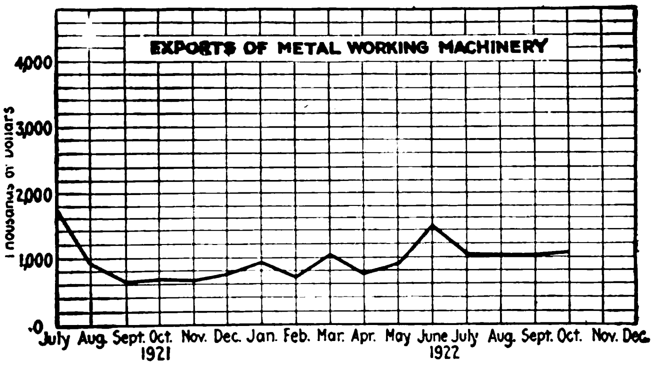
	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb........	$0.0295	$0.0295	$0.0273
Cold finished shafting......	per lb........	0.0378	0.0378	0.0373
Brass rods.....	per lb........	0.171	0.1700	0.15
Solder (½ and ½)	per lb........	0.24	0.23	0.20
Cotton waste..	per lb........	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100......	3.11	3.11	....
Lard cutting oil	per gal......	0.59	0.575	....
Machine oil....	per gal......	0.36	0.36	....
Belting, leather, medium......	off list........	30–10% @50%	40–5% @50%	
Machine bolts up to 1 x 30 in.	off list........	55% @60%	50%@ 65–10%	50%@ 60–10%

Metal working machinery exports held up well during October, considering the European situation, although there was a drop in value as compared with September totals. The value of machinery exports during the month totaled $902,188 against that of the previous month of $1,093,891 and the August total of $1,032,483. As compared with the month of October, 1921, there is shown an increase of over $200,000, the total in that month being $680,931.

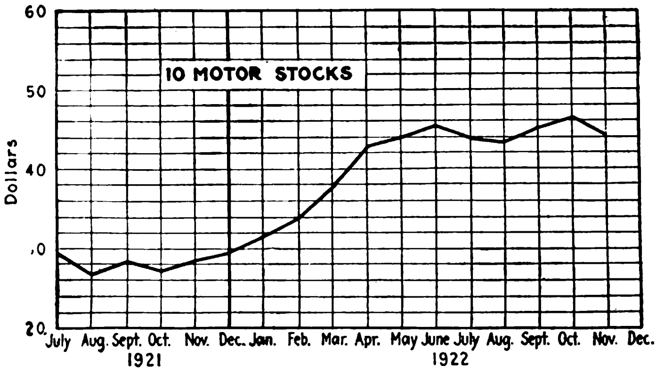
American foreign trade for October shows exports of merchandise totaling $372 millions, a total greater than in any other month since March, 1921, and 19 per cent higher than September exports. Import totals for the month have been delayed due to changes in classifications and rates under the new tariff. A review of foreign trade changes during the fiscal year ending June 30, 1922, by the Department of Commerce, recently made public, shows a decline in the value of imports amounting to 28.6 per cent and a decline in the value of exports amounting to 42.1 per cent as compared with 1921.

Financial conditions as reflected in the statement of the Federal Reserve System, at the close of business Dec. 13, 1922, shows gains of $15,400,000 in gold reserve as against a decrease of $3,500,000 in other cash reserves.

Total value of all metal working machinery exported monthly from the United States, based on returns compiled by the Bureau of Foreign and Domestic Commerce.



Average price of ten automotive stocks: Chandler, General Motors, Hupp. Int. Motors, Pierce, Stewart, Stromberg, Studebaker, White Willys.



Business Conditions in Germany

Machine Tool Exports Decline—Unemployment Still a Serious Factor—Industry Burdened by Taxation

By OUR BERLIN CORRESPONDENT

Recent political developments, chiefly the problem of the stabilization of the mark, have a decided influence upon the course of events. The possibility that the mark will be stabilized in the neighborhood of 3,000 marks to the dollar, has met with considerable skepticism in the business world which has been disappointed too often to put much faith in such announcements.

As a matter of the simplest precaution, buyers are awaiting further developments. The same applies to export sales, which have to be contracted in foreign money. It is clear that under the present uncertain conditions, all purchases not for immediate demand are in abeyance. The business world is receiving an inkling of what will happen, when the stabilization problem is really taken up seriously.

The conviction, that an improvement of conditions cannot be brought about by financial manipulation alone, is spreading and taking deeper root. With the reparation problem in the background for the time being, the public interest is absorbed almost completely by the two great factors, viz., economy and increase of production. Behind these problems is looming up largely and gloomily the huge conflict between the industry and labor, employers and employees.

Machinery Exports Decline

The actual employment of the machine building industry has not receded perceptibly. Reports of shortening of working time are becoming more frequent, but are caused rather by shortage of material and fuel, than by actual lack of orders in hand. The number of new contracts concluded are, however, becoming more and more unsatisfactory. The tendency to retract on orders already booked is also becoming more marked with buyers, and in a number of cases also with sellers. Generally speaking it may be said, that the standard of employment is gradually sinking, but that a fair level can be maintained during the next two or three months. In the machine building industry the ratio of unemployment from August to September decreased slightly from 3 per 1,000 to 2 per 1,000. This is, however, entirely an exception. In all other trades unemployment has increased.

The decline of foreign business found expression in the September returns of exports. Machinery exported has dropped from 42,800 tons in August to 31,000 tons in September. Nearly all classes of machinery are affected by this drop. Machine tool exports for instance, of which, in August, 10,127 single units weighing 3,881 tons were exported, dropped to 7,133 units or 2,412 tons, which is considerably less than in any of the previous months of the year. The total export of machiney and that of machine tools in the first three quarters of the year can be seen by the figures in the accompanying table. As an item of interest, the price per ton realized is added in paper marks and in corresponding gold marks computed at the prevailing rate of exchange.

TOTAL EXPORTS OF MACHINERY FROM GERMANY DURING 1922

1922	Tons	Value Million Marks	Price per Ton Paper Marks	Price per Ton Gold Marks
1. quarter	112,199	3,644	32,500	600
2. quarter	116,715	4,898	42,000	590
3. quarter	110,243	10,571	95,800	390
MACHINE TOOL EXPORTS				
1. quarter	16,593	......	25,400	470
2. quarter	11,900	......	47,800	670
3. quarter	9,276	......	108,000	440

From these figures it can be seen, that the exports in the third quarter fall short of both previous quarters. This is solely due to the bad returns of September, the returns of July and August being in keeping with the previous months. The September exports of machine tools represent a value of 1,440 million paper marks. The price per ton is 172,000 paper marks or 490 gold marks. Nearly all foreign markets have contributed to this decline. It is interesting to note, that machine tool imports in September have kept at the level of August as regards weight, while the number of single tools has increased.

In view of the still continuing business depression in most of the German markets considerable disappointment is also felt that, after a promising start, the Russian market is again closing up. This is explained by the Russian Government to be due to the fact, that the Russian works are now in such a state, that they can largely satisfy the demand. From various reports this appears to be gross exaggeration and is only barely veiling the real reasons, which no doubt are to be found in the realm of finance. This is a hard blow, especially to the locomotive industry, which has been figuring on large business for Russia, especially as the German railroads have considerably reduced their annual requirements. An order for 60 locomotives for Rumania, which it is reported has recently been given, is of course only a small compensation.

Fluctuating Tool Prices

It is illustrative of the rapid movement of prices, that the price directions issued by the Machine Tool Builders' Association are now issued in intervals of 10 days. While the increase of the price over the previous month was in September 45 per cent, it was in October 87 per cent and for the first 10 days of November 93 per cent. At the time of writing prices of machine tools average from 1,000 to 1,500 marks per kg. compared with approximately 1 mark in pre-war times. This is the price for standard tools. Specialities command a considerably higher price. A case your correspondent heard quoted today seems to be about the highest that prices have climbed up to. For a gear cutting machine of the old Gleason type (templet) of 3,000 kg. weight a price of 10 million marks or somewhat over 3,000 marks per kg. is being asked. This is considerably above pre-war standard, even in goldmarks.

Greatly divergent and frequently erroneous opinions prevail in foreign countries with regard to taxation, the German industrial establishments are subjected to. This taxation is threefold:

1. The trade tax, which is levied in progressive proportion of the income. The lowest percentage is 1½ per cent for gross revenues from 15-20,000 marks, rising to 27 per cent for a gross revenue above 3 million marks,
2. The company tax, which is 10 per cent of the net revenues,
3. The capital transfer tax, raised on all capital transactions, like new floatations, loans issued, bonds and the like. This tax is 7½ per cent.

Heavy Taxation Burden

In the case of a company, for instance, which has earned a revenue of 1 million marks per year, after paying all expenses, such as salaries, wages and sundries, and which has raised a loan of 1 million marks, the taxation would be as follows:

First, 20 per cent on the revenue plus such expenditure, which remains subject to the taxation under the law, like rents, interest on loans and mortgages, cost of repair of premises and 40 per cent of new equipment. This taxible expenditure frequently equals and even exceeds the revenue.

Second, the company tax of 10 per cent payable on the amount of revenue remaining after paying the trade tax.

Third, the capital transfer tax of 7½ per cent on the loan of 1 million marks, allowed to be put under deductible expenditure.

In the average the taxes amount to from 35 to 60 per cent of the revenue. The turn-over tax, which is raised on the transfer of any property from one hand to the other by sale, is not included, as it is an indirect tax, which is burdened upon the buyer.

As has already been mentioned in these columns, the credit situation of the industry in this country has somewhat eased in consequence of the huge sums of German money in foreign hands flowing back into the country in the shape of investments in industrial securities. A further source is domestic capital, which, the buying craze having ceased, is again taking notice of the low price of industrial stock. Helped by such conditions, many manufacturing companies again come on the money market with capital and bond issues. The fresh capital obsorbed by the industry in October amounted to 5,374 million marks, which is a record figure in paper marks. In gold marks it is, however, only 5,300,000 marks, a ridiculously low sum in comparison to previous months and years. The total fresh capital the industry received in the first 9 months of the current year by increase of capital stock, bond issues, and the like, is only 309 million gold marks compared with 814 million gold marks last year. This explains perhaps better than words could do, the financial straits, into which the industry has dropped through the depreciation of the money with little relief in sight through adjustment of reparations question.

George Richards Dies in England

George Richards, formerly of George Richards & Co., Ltd., Broadheath, near Manchester, England, and later of the Richards Thread Milling Machine Co., London, England, died on Nov. 17. Mr. Richards was a well known designer of machine tools of

George Richards

advanced type and though he lived in England for many years, never relinquished his American citizenship. He was impoverished by the late war and his financial condition became so low that, pending an appeal to his many friends for assistance, he was forced to become an inmate of the London County House, where he died.

Trade Trip to Cuba

A group of manufacturers from Atlanta and Chattanooga, many of them connected with the metal trades industries, will make a trade trip to Cuba some time during February under the auspices of the Atlanta and Chattanooga Chambers of Commerce, and the Southern Railway System. The purpose of the tour will be to further expand trade relations between Southern manufacturers and the island of Cuba. Within the past few years Atlanta manufacturers and jobbers have built up from practically nothing an export trade with Cuba now in excess of $1,000,000 per year, and there is still room for great improvement. A large part of this export business is in machinery and machinery supplies, machine tools, railroad equipment, and other metal products.

New Worthington Heads

E. T. Fishwick and William Goodman have been appointed vice presidents of the Worthington Pump and Machinery Corporation, 115 Broadway, to fill vacancies made by the resignation of Frank H. Jones and James E. Sague.

Mr. Fishwick was formerly general sales manager and now takes the title of vice president in charge of sales. Mr. Goodman, previously in the executive engineering department, is now vice president in charge of engineering and manufacturing.

Although both Messrs. Jones and Sague have resigned as titled officers they will both remain with the corporation in an advisory capacity.

Business Items

The Goss & DeLeeuw Machine Co., of New Britain, Conn., has incorporated under the laws of Connecticut, with a capital stock of $100,000 to manufacture machinery, tools, etc., operating a plant at New Britain. The incorporators of the company are: Stanley T. Goss, of New Britain, Conn.; John S. Black, New Britain; and Adolph L. DeLeeuw, of Plainfield, N. J.

The Nashville Bridge Co., of Nashville, Tenn., according to officials of the company, is planning the immediate establishment at Bessemer, Ala., of a branch plant to include general shops and units for the production of heavier structural steel. The principal bridge department of the company will remain at Nashville.

The Anderson Tractor Co., recently noted incorporated at Anderson, S. C., proposes the establishment there of a large plant for the manufacture of tractors and sprays for use in cotton fields of the South, according to W. S. Anderson, president of the company. The capital stock of the concern is $200,000.

The Atlantic Coast Line Railroad Co., advises that it is planning the early construction of machine and engine shops and a roundhouse at Port Tampa, Fla., to entail a total investment of approximately $150,000. The work is in charge of the engineering office of the railroad at Wilmington, N. C.

The Crane Co., of Chicago, has established an additional southern branch at 738 West Bay Street, Jacksonville, Fla., this branch to serve the company's trade in South Georgia and all of Florida. The Atlanta branch serves the rest of Georgia and nearby states. P. Z. Huddleston is named manager of the Jacksonville branch.

The National Cast Iron Pipe Co., of Tarrant City and Birmingham, Ala., at the annual meeting of the stockholders and officers to be held the latter part of December, will consider a plan to increase the capital stock from $500,000 to $1,000,000 and favorable action is expected. A larger production during 1923 through the establishment of additional units, and a further expansion of its export facilities is the plan of the company.

Lorne Tractors, Ltd., which has been incorporated for $300,000 at Tillsonburg, Ont., and is erecting a new factory there to build a gasoline equipment, including fire engines, has elected the following officers: L. Carmichael, president; J. M. Clark, vice-president; and L. C. Vangeel, secretary-treasurer.

The Fleming Machine Co., formerly located at 172 Chestnut St., Springfield, Mass., has removed its office to 41 Mercantile St., Worcester, Mass.

The North & Judd Manufacturing Co. in order to keep up with the demand for "Anchor Brand" hardware products has reopened its New Haven plant which was purchased in 1919. The foundry department is now in operation with a large number of moulders.

The Terry Steam Turbine Co., manufacturer of turbines, blowers, etc., of Hartford, Conn., with branches in Chicago, New York, Philadelphia and Pittsburgh, has recently increased its capital stock from $700,000 to $800,000. The number of shares was also increased from 7,000 common to 4,000 of common and 4,000 of preferred stock.

The Pequennock Foundry, Inc., 5th St. Extension, Bridgeport, Conn., has recently increased its capital stock from $10,000 to $50,000.

The Hartford Tool Works, Inc., maker of tools, etc., Hartford, Conn., has filed a preliminary certificate of dissolution with the Secretary of the State of Connecticut. All claims against the company should be mailed to Richard H. Deming, 36 Pearl Street, Hartford, Conn.

The Precision Instrument Co., Inc., has acquired control of the Precision Instrument Co. of Newark, N. J., well known for its line of "3 in 1" draft gauges, pressure recording instruments, CO_2 recorders, specific gravity recorders, laboratory gas meters, gas calorimeters, and other lines. The present executive officers, who have been so successful, will retain their connection with the company. It is expected to enlarge the business considerably, with new capital, adding other specialties, besides staple lines of gauges, valves and fittings. The company's New York office will be in the Engineering Building, 114 Liberty St. The factory will later be moved to New York.

The Kemp Machinery Co., 215 N. Calvert St., Baltimore, Md., has been appointed exclusive representative by the Diamant Tool and Manufacturing Co., 91 Runyon St., Newark, N. J., in connection with the sale of Diamant standard punch and die sets, in the territory covered by the states of Maryland, Virginia, District of Columbia and West Virginia consisting of Jefferson, Berkley, Morgan, Hampshire, Mineral Hardy, Grant, Pendleton, Randolph, Pocahontas, Green Brier, Monroe and Mercer Counties.

The R. S. Leafless Spring Co., of Fresno, Cal., has been organized with Frank Waterfield, Mason Building, in that city, at its head and will engage in the manufacture of a new spring for motor vehicles to eliminate the necessity of shock absorbers. The new company is capitalized at $150,000.

The National Iron Works, San Diego, Cal., has filed articles of incorporation, to establish and operate foundries, with capitalization of $100,000. The incorporators are James R. Russell, C. H. Martin and Leo G. Moore.

The Missouri Boiler Works Co. of Kansas, has been incorporated to do business in Missouri with headquarters in Kansas City. The company will manufacture and sell boilers, engines, smoke stacks and all other machinery used in boiler shops and factories. The incorporators are I. H. Darby, E. D. Proudfit and F. I. Darby.

The North Missouri Power Co. of Excelsior Springs, Mo., has filed articles of incorporation with Secretary of State at Jefferson City, showing a capitalization of $1,700,000. The company will carry on an electric power, light, gas, waterworks, hot water and steam heating business. The incorporators are S. W. Henderson, H. L. Moore, C. W. Fish, W. E. Crawford and F. A. Boys.

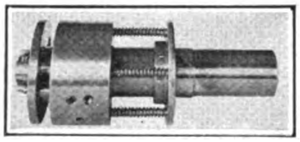
The Spencer Turbine Co., manufacturer of turbines, etc., Hartford, Conn., has recently increased its authorized capital stock from $300,000 to $600,000.

The North & Judd Manufacturing Co., manufacturer of hardware and

Condensed-Clipping Index of Equipment

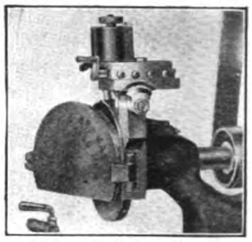
Patented Aug. 20, 1918

Taps, Pipe, Collapsible, Receding-Chaser
Victor Tool Co., Waynesboro, Pa.
"American Machinist," October 26, 1922



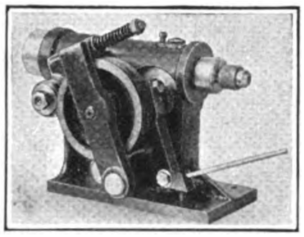
The stationary lever-operated type and the rotary type of tap have been re-designed. The short chasers are made to recede as the tap enters the work. In the stationary type two cam blocks work in conjunction to give a positive control to the receding chasers. In the rotary type a ring is used for setting the collars and chasers in position for cutting, which can be accomplished without stopping the machine. Both styles have a means for adjusting the diameter, with a range of $\frac{1}{16}$ in. over or under size. By adjusting the trip collar, any length of thread can be cut. Interrupted thread chasers are used for tapping steel. The tap is furnished in sizes from 1$\frac{1}{4}$ to 12 in. in diameter.

Wheel-Truing Device, Angular
Wilmarth & Morman Co., Grand Rapids, Mich.
"American Machinist," October 26, 1922



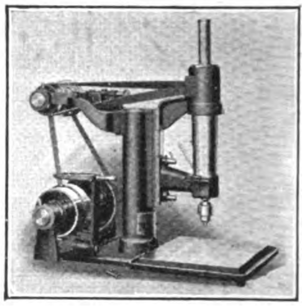
The device is intended for use in shops salvaging and reclaiming worn-out milling machine cutters, reamers and drills, as well as those making a specialty of cast stellite cutters and tools. With the device, the wheel can be easily formed to correspond to the outline to be ground. The diamond is fed to the wheel by means of the knurled knob at the top, while the crank is employed to feed the diamond across the face of the wheel. By means of the graduated dial, the device can be set at the desired angle, the diamond carrying member being tilted to either side for dressing the wheel face at an angle. The wheel can be properly dressed without disturbing the set-up of the work.

Drilling Machine, Sensitive, Automatic, Horizontal, No. 8
Kingsbury Manufacturing Co., Keene, N. H.
"American Machinist," October 26, 1922



The machine head has a fully automatic feed and control similar to that on the vertical model. The cam gives a stroke of 1 in. to the spindle with a maximum feed of 0.011 in. per revolution. The head can be mounted on the base in multiple and supplied with automatically operated work-holding fixtures for high production on special work. It can be driven by either a countershaft or $\frac{1}{2}$-hp. motor. Capacity, drills from No. 60 to $\frac{1}{4}$ in. in diameter. Spindle: adjustment, 2 in.; travel, 1 in.; height above the base, 6$\frac{3}{4}$ in. Height, 9$\frac{1}{2}$ in. Weight, 50 pounds.

Drilling Machine, High-Speed, Bench, No. 0
Sigourney Tool Co., Hartford, Conn.
"American Machinist," October 26, 1922

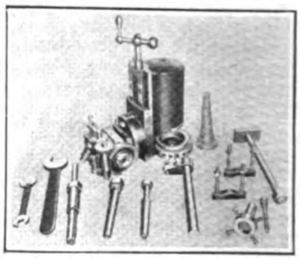


The machine is of the belt-driven type with two countershafts adjustably mounted on the frame. The tension of the belt is adjusted by changing the distance between the countershafts. There is no center hole in the spindle, but the lower end is fitted to the taper socket of a No. 1 Jacobs drill chuck with a capacity for drills from 0 to $\frac{1}{16}$ in. in diameter. Spindle speeds of 2,000, 4,000 and 8,000 r.p.m. are furnished, but by increasing the speed of the first countershaft higher speeds may be obtained. Spindle movement, 1$\frac{1}{2}$ in. Table surface, 7$\frac{1}{2}$ x 8 in. Vertical adjustment of head, 2$\frac{1}{2}$ in. Maximum height, table to chuck, 3$\frac{1}{2}$ in. Bench space, 12 x 20 in. Weight, 50 pounds.

Hoist, Chain, Electrically Operated, "Motorbloc"
Motorbloc Corporation, Summerdale, Philadelphia, Pa.
"American Machinist," October 26, 1922

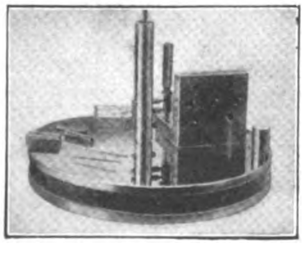
The device can be installed by attachment to lighting or power circuits. It consists of a standardized steel chain hoist, electrified by the application of a heavy-duty motor, reduction gearing and a slip friction clutch, all mounted on a supporting bracket to form a self-contained electrifying unit, to which the pendant controller is attached. The electrifying unit can be applied to standard chain hoists already in service. Where electric current is not available the hand chain can be quickly applied. The mechanism is for use on chain hoists having capacities from $\frac{1}{2}$ to 10 tons. Provision is made for adequate automatic lubrication of the armature shaft and worm. The pendant controller can be easily operated by one hand. Weight of 1-ton size, 148 pounds.

Milling Attachment, Multi-Purpose, "Millerette"
Production Machine Tool Co., 629 E. Pearl St., Cincinnati, O.
"American Machinist," October 26, 1922



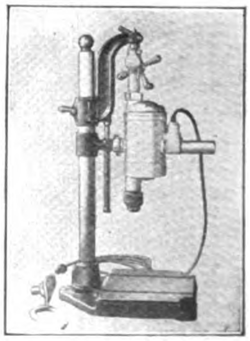
The device can be set at any angle and is built in three sizes for lathes with from 12- to 24-in. swing. It converts a lathe into a milling machine for cutting spur and bevel gears, for surface milling, angle cutting and spline and keyway cutting. The attachment fits the toolpost slot in the top slide of the compound rest of the lathe. The lathe supplies the power, carries the cutter on an arbor between centers and gives both longitudinal and cross feeds. The down slide of the Millerette can be operated by a handle. The Millerette can be used on a drilling machine to accurately space the holes to be drilled and to hold work requiring indexing; and on planers and shapers as a dividing head. The index plate shows the gears to be used and the number of turns of the index handle required to obtain from 2 to 360 divisions.

Surface Plates, Steel, Hardened, Lapped
Van Keuren Co., 362 Cambridge St., Boston 34, Mass.
"American Machinist," October 26, 1922



The plates are suitable for general use, as well as in the toolroom. They are free from the hills and valleys arising from hand scraping and have been tested by light waves for planeness, during manufacture. The plates are furnished in 5-, 8- and 10-in. diameters and are made with two handles which screw into the edges of each plate. A wooden box protects the surface when not in use. The plates may be used with a dial gage for the inspection of small parts and for sine bar set-ups. Gage blocks may be wrung directly on the surface plates.

Drill, Electric, Portable, with Bench Stand
A. F. Way Co., Hartford, Conn.
"American Machinist," October 26, 1922



With the portable stand the tool can be converted into a bench or floor drilling machine. The drill, which is complete without the stand, may be used as a hand tool. The breast plate and handle are instantly attachable to the drill by the same "union" couplings holding the drill to the stand. The screw feeding mechanism is separate from both drill and stand. Because of the right-angle mounting of the handwheel, the feed may be used in very close quarters. The special motor is of universal type either d.c. or a.c. and can be furnished for 110 or 220 volts. Capacity of chuck, $\frac{3}{8}$ in.. Mounted upon stand: maximum distance chuck to base, 14 in.; vertical adjustment, 6 in.; weight, 115 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

tools, New Britain, Conn., announces the re-opening of its New Haven, Conn., plant, and the foundry is now in operation with a large number of workers. The plant was formerly owned by the W. & E. T. Fitch Co., New Haven.

The Brooks Machine Works, 225 West Lewis St., Wichita, Kan., is installing some new machinery. The new equipment, according to J. M. Hackney, president of the company, will make it one of the best equipped shops in that city.

The Frasse Steel Works, Inc., Hartford, Conn., has been appointed the exclusive New England distributor for the Sizer Steel Corporation with plants at Buffalo and Solvay (Syracuse), manufacturer of electric carbon alloy and tool steels, bars, billets and forgings.

The Brown & Zortman Machinery Co. has been appointed exclusive agent in the territory of West Virginia, the western part of Pennsylvania and the southeastern part of Ohio, by the Wilmarth & Morman Co., Grand Rapids, Mich., for its complete line of grinding machines.

The Carpenter Steel Co. of Reading, Pa., has announced officially that reports recently circulated regarding the merger of the company with some other steel concern are entirely erroneous. No such negotiations, it is announced, are pending and the Carpenter company contemplates no change in ownership or management.

Manning, Maxwell & Moore, Inc., has been appointed exclusive agent in the states of New York, New Jersey, Delaware, Maryland and Pennsylvania east of Altoona, by the Wilmarth & Morman Co., Grand Rapids, Mich., for its complete line of grinding machinery.

The St. John Shipbuilding and Dry Dock Co., Ltd., has nearly completed the construction work on its machine shops at St. John, New Brunswick. The shops, which are of modern type, will be opened in the spring in connection with the dry dock now being built at St. John, N. B.

The T. McAvity and Sons, Limited, of St. John, New Brunswick, manufacturer of hydrants, gages, valves, steel and copper pipe, boilers, etc., is gradually moving its machine shops to the new plant of the company near the city limits of St. John. There are three new buildings of steel, concrete and glass.

The Lunenburg Machine Works and Foundry Co., operating a plant at Lunenburg, Nova Scotia, has been operating steadily, and indications are that the company will keep the plant in operation on full time through the winter.

The Canada Car Co. plant at Amherst, Nova Scotia, is expected to start work on a big car order soon after Christmas. The Canadian National Railways' management intends to order several thousands of new freight cars in order to cope with the demand for cars. The machine shops of the car company are being made ready in anticipation of a big order.

The Canadian Pacific Railway machine shops at McAdam, New Brunswick, are working on full time and report is current regarding the possibility of a new machine shop building being erected at McAdam early in the spring to be ready for next fall.

Personals

ARTHUR L. COLLINS, for the past six months associated with the Standard Steel and Bearings, Inc., has entered the tool and alloy steel department of Horace T. Potts & Co., Philadelphia, as sales metallurgist. His work will be with the various mills turning out the Potts' brands of steels and with the users of these steels in advising on applications and heat treatments.

ALFRED B. CARHART has resigned his position as vice-president and sales manager of the Crosby Steam Gage and Valve Co., to become president and general manager of the Precision Instrument Company, Inc., 21 Halsey St., Newark, N. J.

MARK L. SPERRY, JR., assistant to the superintendent of the Scovill Manufacturing Co., Waterbury, Conn., has been appointed Naval Aide on the Staff of Governor-elect Charles A. Templeton, of Connecticut. Mr. Sperry is a lieutenant-commander, resigning from the Navy in 1921.

MITCHELL S. LITTLE, president of the M. S. Little Manufacturing Co., plumbers' goods manufacturer, Hartford, Conn., and also president of the Sigourney Tool Co., tool maker, Hartford, Conn., has recently been elected a director of the Hartford-Aetna National Bank, of that city.

COLTON D. NOBLE, formerly sales manager of the North & Judd Manufacturing Co., hardware and tool manufacturer, New Britain, Conn., will return to the company shortly. Mr. Noble left the concern back in 1918, to associate himself with the M. S. Brooks Co., maker of brackets, hooks, hardware, etc., of Chester, Conn.

MAJOR EMIL MANWEILER, general manager and secretary of the various plants of the Eastern Malleable Iron Co., with headquarters at Naugatuck, Conn., has been appointed aide-de-camp on the staff of Governor-elect Charles A. Templeton, of Connecticut.

JOHN M. BURRALL, secretary and general manager of the American Ring Co., manufacturer of castings, holders, stampings, etc., of Waterbury, Conn., has been appointed an aide-de-camp on the staff of Governor-elect Charles A. Templeton, of Connecticut.

Obituary

W. B. EVERETS, general traffic manager, Westinghouse Electric and Manufacturing Co., died Dec. 5 at his home 328 Emerson Ave., Pittsburgh, where he had been confined for one week with pneumonia. Mr. Everest was born July 3, 1868, at Newark, N. J.

MISS IRENE PECK SCHOFIELD, for about 15 years secretary of the Universal Boring Machine Co., Hudson, Mass., died at her home in that city Dec. 3. Miss Schofield was a native of Hudson, active in social and political work and was a candidate for local office at the recent election.

JOHN HERGET, since 1904, treasurer of the Century Electric Co., St. Louis, Mo., died at his home in that city, Nov. 14, 1922.

Book Reviews

Production Grinding. By Fred B. Jacobs. Two hundred eighteen 6x9 in. pages, illustrated. Cloth boards. Published by the Penton Publishing Co., Cleveland, Ohio. Price $3.00.

A book describing the grinding operations performed in a number of plants engaged on large-scale production work. A number of the chapters have appeared from time to time as articles in *Abrasive Industry* of which the author is editor. No attempts are made to explain theories of grinding nor to assemble data for the selection of types of machines and grit and grade of wheels for various kinds of work, but perhaps it is just as well that a book on production grinding was confined to a recounting of how individual operations are actually being done. For almost all operations specifications are furnished as to kind of machine, material and wheel; in some cases, further information is given, such as speeds of wheel and work, amount of stock removed, and production per hour. From a literary viewpoint no great praise can be given, a characteristic of too many technical books. Illustrations for the most part are good.

Included in the contents are chapters on grinding parts of the Marmon, Packard, Oakland, Chevrolet and Ford automobiles, tractor parts, chilled iron cams, ball and roller bearings, dental parts, paper mill and chilled iron rolls, milling cutters and dies, and regrinding automobile parts.

The Control of Quality in Manufacturing. By G. S. Radford, Consulting Engineer. Three hundred ninety-one 6x9 in. pages illustrated. Cloth boards. Published by the Ronald Press Co., 20 Vesey St., New York, N. Y. Price $5.00.

An unusual book, carefully planned and well written. It points out, what so many times is overlooked, that quality in manufacturing is essential, not only as such, but as a determining factor in quantity production. Much of the book is devoted to the subject of inspection, and very properly so. Had it not been for the war, the vital importance of thorough inspection in all manufacture would probably not have been realized for many years. Necessity to live up to the letter of specifications compelled many manufacturers to discover methods of maintaining quality, methods that have since been adopted as indispensable. It is an attempt to show the true relation of quality to quantity, sales and cost, that the book was written.

Chapter I consists of an introduction which is a logical plea for quality in all manufacture. The second chapter leads up to the subject of inspection, to which the third to eleventh chapters, inclusive, are devoted. The remaining chapters deal with quality control in practice, measurement and errors, quality defined, working standards, repetition manufacturing, the dimensional control laboratory, gages and gage-checking, thread gaging, the precise control of processes, the control of color, the scientific attitude of mind and its methods, the method of attack to control quality.

Dyke's Automobile and Gasoline Engine Encyclopaedia. By A. L. Dyke. Thirteenth Edition, enlarged and entirely rewritten. 1,238 pages, 7 x 10, illustrated. Published by Goodheart-Wilcox Co., 2009 South Michigan Blvd., Chicago. Price $6.

It is a pleasure to review an old friend such as this book which has gone through twelve successful editions and now appears in its thirteenth. The reviewer found an earlier edition an invaluable aid in his work with aviation cadets during the war and is well acquainted with its merits.

In rearranging the text and illustrations for the current edition, the author has wisely eliminated the chart pages made up of groups of illustrations and inserted the several sketches in the body of the text so that it is unnecessary to hunt around for an illustration when one is referred to.

At the beginning of each chapter the fundamental principles underlying the subject under discussion are outlined and the details are worked in afterward. Not only is the function of every part of an automobile completely covered, but its maintenance and repair as well. The book should be quite as valuable to the garage repairman as to the car owner.

Thirteen principal sections are embodied in the book as follows: I, Assembly of the Automobile; II, Automobile Electric Systems; III, The Storage Battery; IV, Wiring Diagrams; V, Ignition and Carburetion; VI, Tires; VII, Garage and Shop Equip-

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

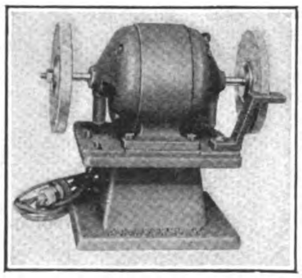
Press, Punch, Combination Foot and Power
A. F. Way Co., Hartford, Conn.
"American Machinist," October 26, 1922

As a foot press the machine is of the pendulum type, actuated by a swinging foot-lever, or pendulum, which is permanently attached to the machine. A positive stop limits the downward movement of the ram. Changing the position of the bolt attaching the pendulum to the upper lever, converts the tool into a strongly driven power press, actuated by an eccentric and the toggle levers at the rear. A 2¼ in. square hole through the bed allows for the passage of blanks through the dies. A 5 x 12-in. surface is available for attaching the dies. Vertical adustment of the ram is secured by placing blocks above and below the rounded end of the actuating lever. A slotted disk at the end of the shaft provides for the attachment of roll or other automatic feeds. Stroke of press, 1 in. Weight, 325 pounds.

Metal, Bearing
Stewart Manufacturing Corporation, 4535 Fullerton Ave., Chicago, Ill.
"American Machinist," October 26, 1922

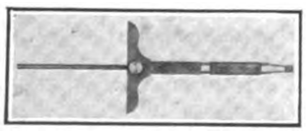
This bearing metal is an inseparable composition of copper and lead which can be remelted and cast any number of times under ordinary foundry conditions without segregation. It is especially adaptable for bearings where lubrication sometimes fails. Above 600 deg. F. the metal sweats lead and lubricates itself, and 1,700 deg. F. is the melting point. The metal is made in four degrees of hardness, to suit all operations and requirements. Grades B, C, D and E vary in Brinell hardness from 25 to 80, the latter being intended for heavy service. Standard bushings of the metal are made in 316 sizes, this range being calculated to meet nearly all ordinary requirements. The metal is furnished in the form of tubes, which are finished all over and made in 13-in. length instead of the 12-in. length.

Grinder and Buffer, Bench, Portable, "Special"
J. G. Blount Co., Everett, Mass.
"American Machinist," November 2, 1922



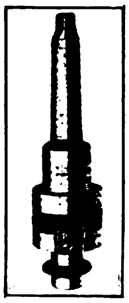
The machine is a plain bearing, motor-driven combination grinder and buffer and is suitable for light work in garages and repair shops. It is driven by a single-phase motor giving ¼ hp. at 1,800 r.p.m. and supplied for either single-phase a.c. of 110 or 220 volts and 60 cycles or d.c. of 32, 110 or 220 volts. The ground spindle runs in wick-oiled bronze bearings and carries a 6 x ¾-in. grinding wheel and a 7 x ⅜-in. sewed buffing wheel. The base of the machine carries a cast iron toolrest and is slotted so that guards can be fitted for the wheels. If it is desired to use the machine as a small power unit, a 2-in. V-belt pulley can be furnished on the spindle between the flange and the motor bearing. Weight, 42 pounds.

Gage, Depth, Spring
L. S. Starrett Co., Athol, Mass.
"American Machinist," November 2, 1922



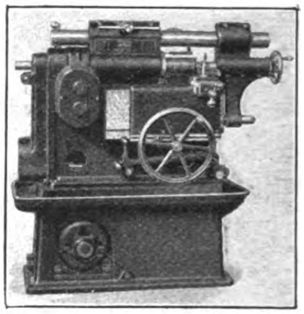
The spring in the barrel automatically forces the rod downward and the clamp screw locks the rod in position. The gage has a capacity up to 3 in., its principal use being the measuring of depth of drilled holes. The gage has a base 2⅝ in. long and the rod itself is ⅜ in. in diameter. The base and the contact point of the rod are not lapped, but are tempered and ground. The contact end of the rod is square instead of convex, for easier manipulation when measuring from a plane surface to a very narrow shoulder.

Chuck, Collet, Quick-Change, Improved, "Wizard"
McCrosky Tool Corporation, Meadville, Pa.
"American Machinist," October 26, 1922



The device is simpler and sturdier than the original model. The chuck consists of two main parts, a driving body having a Morse taper shank to fit the spindle of the drilling machine, and a hardened slotted collar to hold the collet in the driving body. The bayonet locking slots in the collar admit the driving lugs of the collet. The construction permits the operator to insert or release the collet with one hand without slowing or stopping the machine. The tool is inserted by merely pushing the collet up into the revolving chuck, where the automatic latch instantly locks it. The tool is released by pressing the knurled collar of the chuck so as to retard it. The chuck holds the same sizes and styles of collets employed on the former model.

Lathe, Stub, "Sundstrand"
Rockford Tool Co., 2400 Eleventh St., Rockford, Ill.
"American Machinist," November 2, 1922



The machine is intended especially for turning automotive pistons. The carriage ways and headstock are one casting. The heavy tailstock is clamped to a large overhanging arm supported on a stud protruding from the bed. The 18-in. carriage has bearing for its full length both on the face on the front side of the bed and on an angular surface on the top. The front toolslide is wide enough for several tools to be clamped on at one setting. The rear tool is mounted on a slide having a cross travel of 4 in. A 5-hp. motor running at 1,800 r.p.m. is fastened on a pivoted frame inside the bed. Capacity between centers, 12 in. Spindle speeds, 40, 50, 65, 85, 110 and 145 r.p.m. Feeds: Six, from 0.020 to 0.090 in. per rev. Weight, 3,000 pounds.

Drills, Electric, Portable, ¼- and ⅜-Inch
C. L. P. Electric Co., 62 Dey St., New York, N. Y.
"American Machinist," November 2, 1922

Both machines are driven by universal motors furnished for either 110 or 220 volt current. The armature runs on ball bearings and a fan is provided for air-cooling the motor. The table can be removed without disturbing any inside connections of the drill. The drill is equipped with a three-jaw Jacobs chuck, threaded to the end of the spindle. Extension spindles can be supplied. The large handle on the ¼-in. drill at the rear of the motor is equipped with a switch that stays in either the on or off position. A stand can be furnished for precision drilling. The ⅜-in. drill is equipped with a grip handle and two side handles in one of which a switch is placed. Each machine is furnished with a plug and a 10-ft. cable.

Drilling Machine, Bench, with Plain Bearings, No. 1
Sigourney Tool Co., Hartford, Conn.
"American Machinist," November 2, 1922

This machine is similar in design to the ball-bearing, high-speed drilling machine, but is intended for slower speeds. Except for a ball thrust bearing to take the drilling pressure, the parts run upon plain bronze bearings. A chuck holds drills up to $\frac{5}{16}$ in. in diameter, although for larger sizes taper-shank drills are used. The spindle has a taper hole to take a No. 1 Morse taper shank, and a vertical movement of 2¼ in. It is balanced by a coil spring concealed in the case of the spindle bracket. A clamp stop is provided to regulate the depth of the hole drilled. The head may be adjusted vertically upon the face of the column through a distance of 6 in. Three changes of speed are available. An overhead countershaft can be furnished. Table, 10½ x 14 in. Weight, 170 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

ment; VIII, Repairing and Overhauling Engine and Car; IX, Oxy-Acetylene Welding; X, Commercial Cars; XI, Tractors; XII, Ford Car, Tractor, etc.; XIII, Data, Specifications, Horsepower, Useful Information.

A dictionary of motor terms is included in this edition and an elaborate index in which each subject treated is indexed in three ways: In its relation to parts; in its relation to the operation of the car; in connection with the make of the car.

Technical Procedure in Exporting and Importing. By Morris Rosenthal. 312 pages with index. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City. Price $3.00.

In this handy little volume on foreign trade the author has described in detail the mechanics of exporting merchandise from, and importing merchandise into the United States.

The general arrangement of the book is good. It is divided into five main subdivisions or parts, each of which contains short, easy-to-read chapters. The simplicity of the scheme is commendable in that it enables the reader to follow an incoming or an outgoing shipment through the successive steps taken by an overseas shipment with the shipment itself constantly before his eye.

In Part I, the author devotes the opening chapter to defining, in simple language, the terms continually met with in inland and overseas shipment. The export sales contract is then discussed, following which, the matter of routing shipments, ocean bills of lading and commercial invoices are taken up in regular order with a simple treatment of each.

Part II treats of the technique of customs procedure both in the United States and abroad with useful notes to guide the shipper on what to do and what not to do in clearing his incoming or outgoing shipments.

The technique of export packing is covered in Part III with numerous examples illustrative of proper methods to be pursued and dangerous pitfalls to be avoided. Marine insurance and the important question of Financing Export and Import Shipments are treated in Parts IV and V.

In short, the volume furnishes to one interested in foreign trade a picture of the actual handling of export and import shipments in that it clarifies the steps required to be taken after a sale has been made to a foreign customer, or an order has been placed for the purchase of goods abroad. Examples of actual shipments are cited in the book with fac-simile documents met with in ordinary overseas business.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Engineering equipment and supplies, factory furnishings, refrigerator equipment, power transmissions, driving belts, lubricating oils, pipe coverings, etc.—Switzerland. Purchase and agency desired. Reference No. 4510.

Iron sheets for dynamos, iron sheet for transformers, and galvanized-iron sheets—Hungary. Purchase desired. Quotations, c.i.f. Hamburg. Terms: Cash against documents in New York. Reference No. 4512.

Direct connected generator for plant to develop 350 to 500 horsepower, 20 motors from 10 to 75 horsepower, transmission machinery for lumber, a large number of live rolls, a number of trucks, and material for 3 kilns, 20 by 150 feet, inside measurements —Canada. Purchase desired. Quotations, f.o.b. point of shipment. Reference No. 4527.

Woodworking machinery used in the manufacture of umbrellas and parasols—France. Purchase desired. Quotations, c.i.f. French port, in francs. Terms: Cash against documents. Reference No. 4530.

Small tools, steel and copper wire, barbed wire, and general hardware—Australia. Agency desired. Reference No. 4455.

Agricultural machinery of all kinds—Spain. Agency desired. Reference No. 4461.

Machinery for extracting the fiber from flax—Mexico. Agency desired. Correspondence, Spanish. Reference No. 4463.

Machinery specialties, patented metallurgical processes, and metallurgical products—France. Engineer desires representation. Reference No. 4470.

Machinery of all kinds pertaining to the manufacture of linen—Australia. Agency desired. Quotations, f.o.b. New York. Terms: Cash against documents. Reference No. 4473.

Hardware, machinery, and tools—Sweden. Purchase desired. Quotations, c.i.f. Maems or Goteborg. Terms: Cash against documents. Reference No. 4482.

Corrugated iron, structural steel material, wire nails, screws, barbed wire, woven-wire fencing, and automobile accessories—Brazil. Purchase desired. Quotations, c.i.f. Brazilian port. Reference No. 4483.

Any articles used by construction engineers, machine makers, rolling mills, iron founders, and others—England. Agency desired. Reference No. 4486.

Wrought iron and steel pipes and malleable fittings for gas, water and steam pumps and plumbing supplies, such as baths, sinks and lavatories—Norway. Purchase and agency desired. Reference No. 4589.

Hinges, 95 x 55, 110 x 70, 116 x 55, 140 x 70, 160 x 80 and 190 x 80 mm., in packages of 10 or 12—Italy. Purchase desired. Quotations, c.i.f. Palermo. Terms: Cash against documents. Correspondence, Italian or French. Reference No. 4592.

Machinery for a small biscuit making plant and for a soap manufacturing plant —Spain. Purchase desired. Quotations, c.i.f. Spanish port. Terms: Cash against documents. Reference No. 4593.

Machinery for the making of bread, pastry, etc.—Venezuela. Purchase desired. Quotations, c.i.f. Venezuelan port. Correspondence, Spanish or French. Catalogues are requested. Reference No. 4596.

High-speed tool steel, files and drills, to be used in factories, smelters and mines—Poland. Agency desired. Quotations, c.i.f. Danzig. Reference No. 4618.

Machinery to equip a factory for the manufacture of wooden bobbins for textile mills—France. Purchase desired. Reference No. 4607.

Trade Catalogs

Horning and Wiring Presses. The Adriance Machine Works, Inc., 88 Richards St., Brooklyn, N. Y. This company has just issued a new publication of 19 pages, known as Catalog No. 6, illustrating and describing in detail its comprehensive line of horning and wiring presses suitable for manufacturers of tinware, cars, etc. The publication also gives details and illustrations of the company's duplex folding and seaming presses for lock-seamed tinware and for grooving or closing the side seams of round, oval or square cans.

Vanadium Tool Steel. The Colonial Steel Co., Pittsburgh, Pa. The company has just issued a booklet telling the uses, the methods of heat treating, and describing the character of Colonial No. 7 Vanadium tool steel.

Gears. The Boston Gear Works, Norfolk Downs, Quincy, Mass. The company has just issued Catalog No. 41 of 128 pages giving prices, specifications and other information regarding its comprehensive line of gears of all styles carried in stock.

Forges, Blowers, Furnaces, etc. The Buffalo Forge Co., Buffalo, N. Y. A new general catalog (Catalog No. 800) of 180 pages with a complete index has just been issued by this company. The catalog is extensively illustrated with an excellent arrangement and features in detail the company's broad line of forges, hand blowers, post drills, drilling machines, punches and shears—bar cutters, heating furnaces, heating and ventilating apparatus and universal wood cutters.

Power Rotary Shears. The Niagara Machine and Tool Works, Buffalo, N. Y. This company has just issued a new publication known as Bulletin No. 70, covering its line of power rotary shears. It is a twenty-page publication in which are described in detail the various styles of rotary shears with general and detail illustrations, as well as the company's other machinery and tools for sheet metal working. Each machine is accompanied by complete specifications.

Technical Information on Micarta Gears. The Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa. In order to acquaint the industrial gear user with the advantages of Micarta gears, the Westinghouse Electric and Manufacturing Co. has issued a 20 page booklet, Folder 4506, entitled "Salient Facts on Silent Gears." The booklet describes the advantages of the use of Micarta gears and pinions and gives photographs and data describing some of their applications, tables of gear data, etc., enabling the gear user to judge whether or not they are applicable to his machinery.

Metropolitan Subway and Elevated Systems. The General Electric Co., Schenectady, N. Y. The principal characteristics of several great rapid transit systems from an electrical engineering viewpoint are presented in Bulletin 44018 just issued by the General Electric Co. The facilities for power production, transformation, transmission and utilization are outlined briefly for each of the systems in the cities of Boston, Chicago, New York and Philadelphia. The company has taken an important part in the manufacture of various types of apparatus for use on all of these systems. Exhaustive engineering studies and tests have been conducted by engineers to insure to each railway company the selection of exactly the proper equipment for the most reliable and efficient operation.

Modern Piston Specifications. The Modern Electric and Machine Co., Indianapolis, Ind. This company has just issued a publication of 45 pages on modern piston specifications, known as Issue B, in which are given in tabular form, the complete specifications on the company's pistons of all sizes and types for pleasure cars, trucks and tractors.

Borolon. The Abrasive Co., Philadelphia, Pa. The company has just issued a small booklet describing its product "Borolon," a polishing grain for use in all work where emery is now applied. The properties of the article, its method of application and grain size suggestions are embodied in the booklet.

Modern Machine Tools. The Becker Milling Machine Co., Hyde Park, Boston, Mass., and the Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass. The companies named have just issued a catalog listing the land, buildings, modern machine tools, miscellaneous plant equipment, raw materials and supplies which they are offering for immediate sale as a result of the purchase by the Reed-Prentice Co. of the goodwill and business of both companies.

Forthcoming Meetings

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

Universal Patent Exposition, First Annual Convention and exhibit of patents and inventions, Grand Central Palace, New York City, February 17 to 22, 1923. A. B. Cole, 110 West 40th St., New York City, is chairman.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies' Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

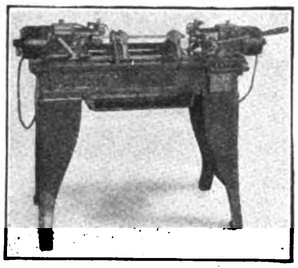
National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society for Testing Materials, Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

Condensed-Clipping Index of Equipment

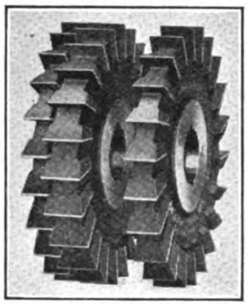
Patented Aug. 20, 1918

Centering Machine, Hand, Duplex
Pratt & Whitney Co., 111 Broadway, New York, N. Y.
"American Machinist," November 2, 1922



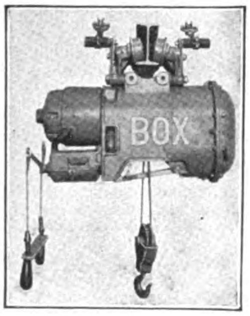
The machine is equipped with opposed drill heads for centering both ends of the work in one operation, but can be supplied with only one head. Both heads are operated together by a hand lever on the right-hand head. The drill spindles are each driven by a ¼-hp. constant-speed motor at speeds of either 1,200 or 1,800 r.p.m. Adjustable stops determine the depth of drilling. Two quick-acting, self-centering vises take all sizes of work up to 2 in. in diameter, and from 3 to 18 in. long. After the work has been centered, it is deposited in a tote box at the rear. Floor space, 4 ft. 6 in. x 2 ft. 6 in. Weight, 600 pounds.

Milling Cutters, Interlocking, "Wiard"
American Standard Tool Works, 402 Owen Bldg., Detroit, Mich.
"American Machinist," November 2, 1922



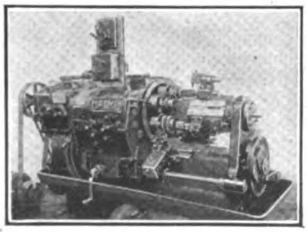
The cutters are so constructed that they can be used singly or in sets. When more than one is employed, the sides of the teeth of one cutter fit into corresponding grooves in the side of the mating cutter. Cutters can thus be ground in pairs, and when the sides of the teeth become dull the relative positions of the cutters can be changed to bring the opposite sides into play. As the cutters become narrowed by grinding, a pair can be spread apart so as to maintain a given dimension. Individual sections can be used as ordinary milling cutters. The cutters are made in standard sizes for diameter, and of such widths that any standard or special size can be obtained by using the cutters in combination.

Hoist, Electric, "Load Lifter"
Alfred Box & Co., Inc., Philadelphia, Pa.
"American Machinist," November 2, 1922



Although the hoist is only 11 in. wide and 28 in. long, it is made for heavy duty. It can be turned through 90 deg. so as to hang parallel with the rail. The trolley is adjustable to run on I-beams from 5 to 9 in. in size. Hook suspension may be used when the trolley is not required. The hoist is built in one size only, to lift 1,000 lb. on a two-part line at 20 ft. per min., and has a drum which will accommodate nearly 80 ft. of rope. Self-aligning S.K.F. bearings are used in the motor, and Hyatt flexible roller bearings at other points. A multiple-disk load brake and a band brake on the motor shaft are both provided for holding the load in position. All parts are lubricated from one point.

Chucking Machine, Six-Spindle, Horizontal
Baird Machine Co., Bridgeport, Conn.
"American Machinist," November 9, 1922

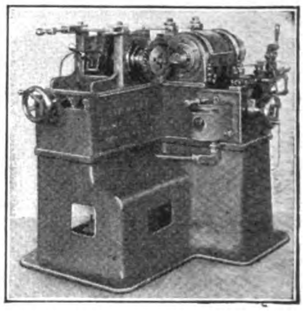


The machine is virtually an automatic lathe for handling five short pieces of work at one time, such as small castings, forgings and bar stock requiring a number of operations such as turning, facing, drilling and threading that can be performed on a lathe. As many as twenty-one cutting tools can be used simultaneously. Separate toolslides are supplied for each working position, with two lengths of feed. There are eight speed changes obtainable by removable gears, and three quick changes of speed, so that twenty-four speeds are available for each spindle. The cutting tools have seventeen changes of feed. Capacity, work up to 6 x 6 in. Spindle speed, from 28½ to 440 r.p.m. Floor space, 93 x 46 in. Weight, 8,500 pounds.

Centering Machine, Automatic, Duplex
Pratt & Whitney Co., 111 Broadway, New York, N. Y.
"American Machinist," November 2, 1922

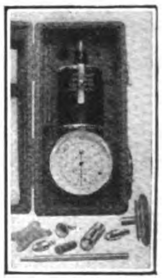
In this machine, an automatically operated feeding mechanism works in conjunction with a magazine. The work is removed from the magazine by transfer slides, placed in the vise, clamped, centered and then released into the work box. The machine is equipped with opposed drill heads for centering both ends of the work in one operation. The feed of the spindles is operated by the cam operating the transfer slides, and driven by a small motor. Each spindle has a feed movement of from 1/16 to ⅜ in. Work from ¼ to 1⅛ in. in diameter and from 2½ to 18 in. long can be held. Oil is supplied to the drills by a geared pump running at a constant speed. Floor space, 4 ft. 6 in. x 2 ft. 6 in. Weight, 1,020 pounds.

Gear-Testing Machine, Bevel
Davenport Machine Tool Co., Inc., Rochester, N. Y.
"American Machinist," November 2, 1922



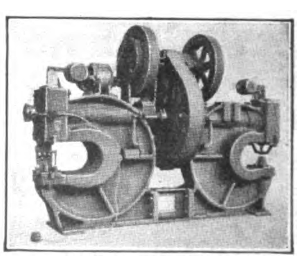
The machine is for subjecting to a running test spiral bevel gears and pinions, tests being made for bearing on the teeth, quietness of running and the center distance at which the best bearing and the least noise occur. One headstock holds the gear and the other the pinion. The pinion is rotated by power and a brake is incorporated to retard the speed of the gear, so that load can be applied. The right-hand headstock is moved back and forth, clamped in position, and the pinion clamped in the spindle by compressed air. The position of the right-hand headstock can be adjusted by the handwheel with a graduated dial located underneath it. Floor space, 4 ft. square. Weight, 1,500 pounds.

Tachometer, Hand
Coats Machine Tool Co., Inc., New York, N. Y.
"American Machinist," November 2, 1922



The hand tachometer is for obtaining a reading directly in revolutions per minute. It is arranged for either three or four ranges of speed for speeds from 30 to 1,600 r.p.m. and can be operated in either direction. Various types of couplings for contact with the shaft, and an extension spindle are provided. A "cutmeter" wheel 6 in. in circumference is employed for obtaining surface speeds. It can be held in contact with a moving surface so that the number of lineal feet of travel per minute can be read on the dial. When the center of the shaft is inaccessible, a thread can be run over a pulley and through the groove on the cutmeter wheel to obtain the circumferential speed. Weight, 1 pound.

Punching and Shearing Machines, Electric-Control, Vertical
Chambersburg Engineering Co., Chambersburg, Pa.
"American Machinist," November 9, 1922



With the electrical control mechanism, the length of stroke and the action of the machine is governed electrically. The mechanism by which the stroke adjustment is made is mounted on the front of the head, and the point at which the stroke will end can be easily predetermined. Depression of the push-button causes the clutch to engage and the head to descend. Two press units can be mounted end to end so that the same motive power can be employed for each. Belt-driven machines without electric control can be furnished. Eight sizes of the machine are made. Smallest size: punching capacity, ⅞-in. hole through a ½-in. steel plate; throat dimensions, 6, 12, 18 and 24 in. Largest size: capacity, 2½-in. hole through a 1-in. plate; throat depth, 15, 24, 36 and 48 inches.

Clip, paste on 3 x 5-in. cards and file as desired

New and Enlarged Shops

Machine Tools Wanted

Ala., Dothan—Dothan Machine Shop—machine shop equipment.

Calif., San Francisco—Continental Furniture Co., 1636 Bryant St.—double spindle boring machine.

Conn., Bridgeport—J. L. Lucas & Son, Inc., 3 Fox St. (machinery)—four Garvan No. 3 duplex milling machines with 40 in. feed.

Ill., Chicago—Reynolds Equipment Co., Lumber Exch. Bldg.—one 36 in. lathe, bed not less than 14 ft.; one radial drill, 5 to 6 ft.; one planer, 48 in. open sides; one 24 in. shaper; one 100 lb. press.

Ill., Chicago—J. Sidor, 5521 Leland Ave.—one engine lathe, 8 to 11 in. swing.

Mass., Lawrence—Champion-International Co., 38 Prospect St., (paper makers)—equipment for proposed machine shop.

Mass., Roxbury (Boston P. O.)—M. Wolbarst, 77 Waumbeck St.—tools and equipment for garage at 143 Washington St.

Mass., Winthrop—J. C. Murray, 15 Putnam St.—equipment for automobile repair shop.

Minn., Minneapolis—Rohne Electric Co., 2434 25th Ave., S., E. J. Rohne, Purch. Agt.—screw machine and spinning lathe.

Mo., St. Louis — H. B. Schwarz, 3926 Washington Ave.—equipment for automobile repair shop.

Neb., Fairbury—Traum & Lien—machine shop equipment.

N. Y., Brooklyn—B. F. Stephens, 1274 Flatbush Ave. (automobile service station)—screw cutting lathe about 8 in. center, between 6 or 7 ft. bed; also drill press suitable for auto work.

N. Y., Buffalo—J. Myers, 258 Bway.—equipment for service station and automobile repair shop.

N. Y., New York—Delaware, Lackawanna & Western R.R., 90 West St., C. C. Hubbell, Purch. Agt.—one 500 ton single-end car wheel press; two 20 in. heavy duty vertical drilling machines; one Whiton 6 in., 2 spindle centering machine; one Whiton, 4 in. 2 spindle centering machine; one duplex control, motor driven, horizontal-boring, drilling and milling machine, spindle 4 in. diameter; one 48 x 48 in. x 10 ft. planer; two 30 in. x 8 ft. heavy-duty engine lathes; two portable belt lathes, 18 in. swing, 4 ft. between centers; one Warner & Swasey No. 2 universal hexagon turret lathe; one 36 in. Morton draw-cut pillar shaper; two motor driven, double spindle floor grinders, wheel 18 in., 3 in. face; two double spindle sensitive drilling machines, ½ to ⅞ in.; one No. 5 Cincinnati plain milling machine; one double end punch and shear, 40 in. throat; two Chicago steel power bending brakes; three 20 in. engine lathes, two for Buffalo and one for Kingston; one 32 in. shaper; for shops at Kingston, Pa.

O., Youngstown—Federal Iron Wks., 70 Prospect St.—machine to bend angles ¼ x 2 x 2 in.

Okla., Okmulgee — Philips Hi-grade Petroleum Co.—machine shop equipment.

Ore., Portland—J. Neelay, 187½ Chester St.—machinist's lathe.

Pa., Boyertown—Eastern Fdry. Co.—machine shop equipment.

Pa., Moores—W. Bozzelle, (contractor and carpenter)—hollow chisel mortiser.

Pa., Pittsburgh—Dusquesne Light Co., 435 6th Ave.—machine tools.

Pa., Pittsburgh—Western Penitentiary, Riverside St., N. S.—list of machine tools.

Tex., Van Alstyne—J. H. Elliott, (repair shop)—electric power lathe and work bench.

W. Va., Logan—Guyan Machine Shops—24 in. shaper vise, 3 to 5 ton trailer, chucks for 22 in. lathes and cylinder grinder for automobile cylinders.

Wis., Cambridge—A. Klavick—repair machinery, storage tanks and pumps for proposed $45,000 garage on Main St.

Wis., Janesville—W. Alderman, 219 East Milwaukee St.—automobile repair machinery, including drill press.

Wis., Milwaukee—E. Todd, 1117 Kinnlekinnie Ave.—drill press and lathe for automobile repair shop.

Wis., Milwaukee—C. W. Valencourt Auto Co., 172 12th St.—electric drilling machine for automobile repair work.

B. C., North Vancouver—J. Crane, 309 East Esplanada St.—machine shop equipment.

Ont., Sarnia—C. McPhee—equipment for garage, to replace that which was destroyed by fire.

Que., Montreal—Quebec, Montreal & Southern Ry. Co., 286 St. James St., N. J. Ferguson, Purch. Agt.—machine and blacksmith shop equipment to replace that which was destroyed by fire, at Sorel.

Machinery Wanted

Ark., Fort Smith—E. Roberts—sausage grinder, cutter, stuffer and lard agitator for power equipment.

Ark., Rumley—Printer—job power printing press, power paper cutter and newspaper cutter (new).

Calif., Fresno—Exide Battery Co., 1347 Van Ness Ave.—additional equipment for battery station.

Calif., Monolith—Monolith Portland Cement Co.—machinery and equipment for the manufacture of portland cement.

Colo., Stonington—News—cylinder newspaper press.

Conn., East Lyme — Niantic Mfg. Co. (manufacturer of cotton goods)—machinery for addition to mill.

Conn., South Norwalk—H. Jacobs & Sons, Day St.—machinery for proposed addition to shoe factory.

Del., Wilmington—J. A. Bader & Co., 923 Market St.—refrigerating machinery for proposed ice manufacturing plant at Clayton.

Fla., Daytona—W. A. Hoffman, Genl. Mgr.—electrically operated machinery and equipment for the manufacture of doors, sash, etc.

Ga., Atlanta — W. H Bradley, Grant Bldg.—one 15 to 25 ton, 8 wheel locomotive crane.

Ga., Brunswick — Overstreet & Son, A. Overstreet, Purch. Agt.—26 x 34 in. job press with power equipment.

Ga., Columbus — The Ricco Co. of America, 938 Bar St.—one syrup agitator, one syrup pasteurizer and two or more storage tanks.

Ill., Chicago—Advance Wood Turning Co., 1345 Rawson St.—8 in. ring machine, also a twisting machine.

Ill., Chicago—Alto Mfg. Co., 180 North Cornelia Ave.—36 in. square shear.

Ill., Chicago—E. M. Heller & Co., 144 West Kinzie St.—saw table, good for 10 in. saw, iron top.

Ill., Kewanee—M. L. Koch, 208 Maple Ave.—complete newspaper and job printing equipment.

Ill., Waukegan—Butler Candy Co., 213 South Sheridan Rd.—power operated candy making machinery.

Kan., Wichita—Stevens & Michels, South Water St., (machinery), P. J. Michels, Purch. Agt. — power combination saw (used).

Kan., Wichita — H. J. Underhill, 131 North Emporia St. (planing mill)—wood working machinery, planer, saw, sander and belting (used preferred).

Ky., Ludlow—Post-Glover Electric Co.—machinery and equipment for the manufacture of electrical devices, to replace that which was destroyed by fire.

Ky., Murray—Johnson & Adams Furniture Co., R. Maddox, Purch. Agt.—complete machinery and equipment for manufacturing, upholstering and repairing furniture for small plant.

Mass., Boston—H. S. Dow, Inc., 35 Newland St.—machinery for new laundry at 70 West Dedham St.

Mass., Conway—Tucker & Cook Woolen Mill, J. F. McDonald, owner—additional machinery for mill.

Mass., Marlboro—Marlboro Dairy Co.—equipment for proposed dairy.

Mass., South Boston (Boston P. O.) — Liberty Marble Co., 80 Granite St.—tools and equipment for the manufacture of marble for new plant at 42 Dillingham St., Boston.

Mass., Waltham—New England Coal Co., Newton St.—elevating and conveying machinery for coaling plant.

Mich., Birmingham—Inter City Bus Line, 207-209 South Woodward Ave.—electric drill; jack shaft and belting; 2 ton chain falls.

Mich., Detroit—Lanza Printing Co., 3133 Rivard St.—pony cylinder press (used).

Mich., Detroit—Michigan Steel Corp., 1708 1st Natl. Bldg.—heavy rolling mills and equipment for proposed steel plant at Ecorse.

Mich., Highland Park (Branch of Detroit)—Ford Motor Co.—coal grinding mills, one kiln with provision for another, slurry tank equipment, 18 in. stocking conveyor, two reclaiming conveyors, slurry pump and rotary coolers for proposed cement factory at River Rouge.

Minn., Wolverton—Hendrickson Bros.—catalogues and prices on machinery for the manufacture of clay brick, blocks and tile. Will be on market about April 1.

Mo., Kansas City—Decker Tin Shop, 111 North Denver St., A. Decker, Purch. Agt.—tinner's press.

Mo., Kirksville—C. C. Howard—complete newspaper equipment.

Mo., Maplewood (St. Louis P. O.)—O. E. Morton, 7421 Manchester Ave.—linotype machine.

Mo., St. Louis—C. A. Axtell, 4400 Easton Ave.—equipment for gasoline filling station on Newstead and Easton Aves.

Mo., St. Louis—St. Louis Southwestern R.R., Railway Exch. Bldg., E. O. Griffin, Asst. to Pres.—machinery for shops at Pine Bluff, Ark. and Tyler, Tex.

Mo., St. Louis—L. Spelbrink, 1321 Franklin Ave., (undertaker)—550 gal. gasoline tank and pump.

Mo., Springfield—North Side Motor Co., 1640 Booneville Ave.—15 to 20 Singer, single needle power sewing machines.

N. Y., Angola—L. L. Brown—ice manufacturing machinery.

N. Y., Buffalo — Central Star Laundry Inc., Main and Northland Ave.—equipment, including one 1,000 gal. gas tank and pump for proposed service station on Northland Ave. and Master St.

N. Y., Buffalo—Holmwood & Holmwood, 328 White Bldg.—equipment, including one 1,000 gal. gas tank and pump for proposed service station on Delaware Ave. and Olive St.

N. Y., Buffalo—C. Johndahl, 169 Allen St.—plumbing shop equipment.

N. Y., Buffalo — W. H. Linford, 2082 Niagara St.—equipment for service station, including one 1,000 gal. gas tank and pump.

N. Y., Buffalo—M. E. Mussen, 10 Fisher St.—equipment for service station, including one 1,000 gal. gas tank and pump.

N. Y., Buffalo — Prene Mfg Co., River Road—machinery and equipment for plant for the manufacture of skid chains.

N. Y., Dundee—W. Fox—machinery for flour and feed mill, to replace that which was destroyed by fire.

N. Y., Hornell—Elmhurst Dairy Co.—pasteurization and milk plant machinery, including machinery for sterilization of bottles.

N. Y., Mayville—Chautauqua Cabinet Co.—woodworking machinery for proposed addition to factory.

N. Y., New York—R. Grant, Woolworth Bldg., (iron and steel broker)—air compressor.

N. Y., New York—Muller MacLean & Co., 195 West St. (machinery agency)—friction saw for cutting pipe.

N. Y., Niagara Falls—Gay Bros.—equipment for bakeshop at LaSalle.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Pig iron firmer in Birmingham and Youngstown districts; slight declines, however, reported in No. 2 foundry iron at Philadelphia, Cincinnati and Chicago. Steel prices, for first quarter, inclined upward; with show of better stability. Bars firm at $2 per 100 lb., Pittsburgh. Improvement in inquiry for structural shapes; $2, uniformly and quite firmly, quoted on all new business. Quotations of $1.90@$1.95, however, frequently apply on large tonnages. Attractive tonnages on new plate business placed at minimum of $1.90@$1.95, with maximum at $2. Demand moderate; confined mostly to car builders.

Electrolytic copper, 14⅞c. as against 14½c. per lb. in New York warehouses, one week ago. Coke plates up ½c. per lb. in Cleveland. Babbitt metal, best grade, advanced 7c. per lb.; roll sulphur, 5c. per 100 lb. and raw linseed oil 3c. per gal., in New York.

Declines—Downward tendency in black and galvanized steel sheets in Pittsburgh and New York. Tin down ½c.; zinc ⅛c. in New York warehouses, during week. Chinese antimony cheaper in Cleveland.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.05
Northern Basic	29.27
Southern Ohio No. 2	28.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.44
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.14
Virginia No. 2	34.17
Basic	27.50
Grey Forge	28.64
CHICAGO	
No. 2 Foundry local	28.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	29.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	27.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cincinnati	4.5@6
New York	5.5
Chicago	4@5
Cleveland	5½@6

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2.50	4.19	3.70	4.00
No. 12	2.60	4.24	3.75	4.05
No. 14	2.70	4.29	3.80	4.10
No. 16	2.90	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20	4.30	4.20	4.70
Nos. 22 and 24.	3.25	4.35	4.25	4.70
Nos. 25 and 26.	3.30	4.40	4.30	4.75
No. 28	3.35	4.50	4.40	4.85
Galvanized	**Pittsburgh**	**New York**	**Cleveland**	**Chicago**
Nos. 10 and 11.	3.35	4.50	4.40	4.85
Nos. 12 and 14.	3.45	4.60	4.50	4.95
Nos. 17 and 21.	3.75	4.90	4.80	...
Nos. 22 and 24.	3.90	5.05	4.95	5.40
No. 26	4.05	5.20	5.10	5.55
No. 28	4.35	5.50	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
$\frac{3}{32}$	8.00		12@13
⅛	6.50		11@12
$\frac{5}{32}$ to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	14.87½
Tin, 5-ton lots, New York	37.50
Lead (up to carlots), St. Louis 6.90;	New York. 7.45
Zinc (up to carlots), St. Louis 7.20@7.25;	New York. 7.87½

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7@7.25	8.37½	7.75
Copper sheets, base	21.50	22.00	23.00
Copper wire (carlots)	16.00	18.00	16.25
Copper bars (ton lots)	20.00	23.00	19.50
Copper tubing (100-lb. lots)	24.75	25.00	23.00
Brass sheets (100-lb. lots)	18.50	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.00	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.75	20.00
Babbitt metal (83% tin)	42.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N.J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.00	12.50	12.00
Copper, heavy, and wire	11.75	11.75	11.50
Copper, light, and bottoms	9.75	10.00	10.50
Lead, heavy	4.75	5.50	5.75
Lead, tea	4.25	4.50	4.75
Brass, heavy	7.00	9.50	9.25
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	6.50	6.50	7.00
Zinc	3.00	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.00	11.50	14.50
IC,		112 sheets	12.30	11.90	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.90	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead, dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.65	
Coke, prompt furnace, Connellsville...per net ton		$6.50@7.00	
Coke, prompt foundry, Connellsville...per net ton		7.50@8.00	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ½ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅜ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25	....	0.15
⅞ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.50	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin.ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

N. Y., Niagara Falls — A. S. Gilman Printing Co., 623 St. Clair Ave.—printing and conveying machinery.

N. Y., Poughkeepsie—Guilder Eng. Co., Fairview St.—shear to cut light sheets.

N. Y., Rochester—Consolidated Milk Co., 45 Fulton Ave.—pasteurization equipment.

N. Y., Rochester—C. Hans, 171 1st Ave.—one set platform scales.

N. Y., Rochester — West Side Pattern Wks., 197 Lyell Ave.—one small size embossing machine.

N. Y., Syracuse—New Process Gear Co., 500 Plum St., C. R. Burt, Mgr.—about $50,000 worth of gear cutting machinery of all kinds.

N. C., Cary — Bd. Educ. — vocational equipment for new school.

N. C., Wilmington — Carter's Production Works, 210 South Water St., (machinery), O. Carter, Mgr.—one 60 in. veneer clipper; 6 ft. stapling machines; rounders for lettuce basket bottoms and heads and potato barrel heads; hardware for making strawberry crates and lettuce baskets.

O., Archbold—Archbold Ladder Co.—machinery and equipment for the manufacture of ladders.

O., Cincinnati—J. R. Wolf & Co., 216 East Pearl St.—drug packing machine.

O., Cleveland—Republic Structure Iron Wks., East 53rd St. and Lakeside Ave.—1 in. capacity, 96 in. blade and 36 in. throat gate shear.

O., Columbus—Bd. Educ., Tower and High Sts., E. L. McCune, Clk.—receiving bids until Jan. 12, equipment for manual training and laboratory departments of Joseph Sullivan High School.

O., Columbus—D. Davidson, 548 West State St. (job printer)—10 x 15 in. press with belting and full equipment.

O., Columbus—Ohlen-Bishop Co., Ingleside Ave. and Simpson Lane, (manufacturer of saws and tools), L. W. Seymour, Purch. Agt.—general machinery to enlarge factory.

O., Columbus—Union Oilcloth Co., 7th Ave., along tracks of Cleveland, Cincinnati, Chicago & St. Louis Ry., R. H. Wilcox, Purch. Agt.—large generator set and special oil cloth machinery.

O., Dayton—Dixie Boiler Co., 954 Riebold Bldg.—punch, shear, air compressor and bent shear (new or used).

O., Marion—Marion Shovel Co., (steam shovels)—motor driven shear for cutting bars.

O., Portsmouth—W. J. Collum Co.—circular shear.

O., Sandusky—Webster Printing Co.—punching machine.

O., Toledo—E. N. Riddle Co., Bway. and Ottawa St., (manufacturer of lighting fixtures, etc.)—foundry equipment.

O., Wellston—Wellston Mfg. Co. (manufacturer of heating furnaces and specialties), I. Warden, Pres.—machinery and equipment for addition to plant.

Okla., Yahola—Yahola Sand & Gravel Co.—washing and screening machinery.

Ore., Portland—I. Flint, 985 Union Ave. N, (job printing)—13 x 19 in. press for power attachment (used preferred).

Ore., Portland — U. McDonald, Supt. Western Lumber & Door Co., 315 Falling Bldg.—complete line of sash and door machinery for planing mill at Vancouver, Wash.

Pa., Barnesboro—Bd. Educ., Dr. G. F. Anderson, Pres.—equipment for vocational department of new school.

Pa., East Pittsburgh—Westinghouse Electric & Mfg. Co.—one 5 ton crane for Homewood plant.

Pa., Franklin—C. P. Wolfe—machinery and equipment for the manufacture of aluminum products.

Pa., Hazelton—C. H. Rice—sawmill machinery and equipment.

Pa., Manyunk (Phila. P. O.)—Keystone Boiler Wks. (manufacturer of steel and boilers)—½ in. plate rotary bevel shears.

Pa., Minersville—H. W. Keith—machinery and equipment for 500 ton coal washery at Pinegrove.

Pa., Mount Jewett — Safety Sled Co.—machinery and equipment for the manufacture of sleds, to replace that which was destroyed by fire.

Pa., New Castle — Universal Sanitary Mfg. Co., C. J. Kirk, Pres.—special machinery and equipment for pottery manufacturing plant at Cambridge, O.

Pa., Phila.—Brandes Bros., 12th and Brown Sts., (dress bindings, goods, etc.)—doubling and wrapping machine, lightweight type, for folding 50 in. fabrics.

Pa., Phila.—J. J. Brooks, 63rd and Mt. Moriah Ave., (contractor and stone mason)—2 ton traveling crane (power).

Pa., Phila.—Bureau of Water, 792 City Hall—receiving bids until Dec. 29, one 8 wheel locomotive crane, steam operated, 46 ft. steel boom, 1 cu.yd. clamshell bucket, 5,800 lb. capacity.

Pa., Phila.—The city, City Hall, C. E. Davis, Purch. Agt.—two sand filtering, washing and conveying machines, self propelled, electrical, to remove, wash and replace sand in filter beds.

Pa., Phila.—E. Clinton & Co., 2119 Arch St., (manufacturers of brushes)—woodworking machines, drills, sanders, planers, etc., for new factory.

Pa., Phila.—M. Colter, 1220 North 42nd St. (laundry)—extractors, mangles, tubs, etc.

Pa., Phila. — Ellis Glautz & Co., 1210 Race St.—stitcher, pressers and miscellaneous tools for leather working.

Pa., Phila.—Gladstone Knitting Mills, 44 North 3rd St., (knit goods)—latch needle machines and other equipment.

Pa., Phila.—R. M. Greene & Co., 1418 Vine St., (manufacturer of cabinets and soda fixtures), R. M. Greene, Jr., Purch. Agt.—additional woodworking machinery, radial drills, presses, etc., for new factory.

Pa., Phila.—Penn Seaboard Steel Corp., 1417 Sansom St., (castings), G. A. Pedrick, Purch. Agt.—one 9 to 12 ton capacity, double frame steam hammer with pressure of 150 lb. per sq.in.

Pa., Phila.—H. M. and E. B. Siner, Church St. and Tacony Ave., (textiles and dyers)—dyeing machines, dryers, etc., for new plant.

Pa., Phila. — J. M. Tompkins, Belgrade and Orthodox St., (manufacturer of small machine parts and talking machines) — additional equipment and small tools for new plant.

Pa., Phila.—A. Wackerman, 859 Church Lane, (sheet metal works)—brakes and other metal working machines.

Pa., Phila.—J. J. Wilson, 2927 Ellsworth St.—additional equipment for woodworking plant, including planers, tenons, saws and drills.

Pa., Pittsburgh—Guibert Steel Co., 703 Diamond Bank Bldg., S. E. Bachtel, Purch. Agt.—air compressor for steel fabricating work.

Pa., Pittsburgh—Hanlon Gregory Galvanizing Co., 24th St.—monorail system for new plant at 54th and Butler Sts.

Pa., Pittsburgh—Jones & Laughlin Steel Co., 3rd Ave. and Ross St., A. Ochsenhirt, Purch. Agt.—one 15 ton crane for Aliquippa works

Pa., Pittsburgh—Pittsburgh Steel Co., Frick Bldg., H. Llewellyn, Purch. Agt.—tube piercing machinery.

Pa., Reading—R. McCain, Green and Cedar Sts. (hosiery)—several ribbers, Huse or Wildman (used).

Pa., Saint Marys—Elk Graphite Milling Co.—machinery and equipment for the manufacture of graphite products.

Pa., Wampum—Crescent Portland Cement Co.—air compressor.

Pa., Warren—Crew-Levick Co.—oil filter station equipment to replace that which was destroyed by fire.

R. I., Providence—W. B. Dunn Co., Industrial Trust Bldg., (textile spinning)—two twisters, double roll with 2¼ or 2½ in. rings (used).

Tenn., Chattanooga—G. G. Raoul, Pres., West 1st St.—enameling machinery and equipment.

Tenn., Knoxville — Knox Porcelain Co. (manufacturer of porcelain specialties), J. House, Pres.—complete machinery and equipment for plant.

Tenn., Nashville—Federal Can Co., 500 Benton Ave.—machinery and equipment for $20,000 addition to plant.

Tex., Dallas—J. Kirby, 1007 Dale St., (newspaper)—6 x 9 in. power job press.

Tex., Dallas—Paternostro Mfg. Co., 305 South Ervay St., (machine shop)—oxy-acetylene welding outfit complete.

Tex., Pioneer—Amer. Oil Co., T. Ryan, Pres., machinery and equipment for proposed refinery.

Tex., Sherman—E. C. Hunter, (newspaper)—6 quarto or 7 folio news press.

Va., Martinsville—Amer. Furniture Co., (manufacturer of bedroom and dining room furniture), A. D. Witten, Pres.—

Jointer.
Clamps, two 36 in. sections.
Two joint glue spreaders.
Two 250 lb. glue kettles.
One vegetable glue spreader.
One 76 in. hydraulic press.
One rip saw with motor.
One 84 in. veneer jointer.
One 80 in. clipper.
One 86 in. x 64 in. dryer.
Two planers (one 36 in. round head), (one 30 in.—3 knife sq. head).
Jointer, 18 in.
Three No. 5 cutoff saws.
Four dry kilns, 110 ft. long, 80 ft. wide, end piling.
Lumber lifts.
Rip saws, No. 15.
Molders, No. 35 (one No. 6 and one No. 12).
Tenon machine, double end.
Tenon machine, single end.
Endless bed sander, triple drum.
Band saw, 25 N. P. motor.
Filing room equipment, including tension roll for 6 in. band saw, grinder and knife grinder.
Sidney lathe, 20 in. swing.
Jointer, 12 in.
Double trim saw.
Dovetail machine.
Dovetail machine, 12 spindle.
Two 42 in. band saws.
One jig saw.
Mitre saw.
Lathe.
One shaper.
Two buss shapers.
Variety saw.
Six-spindle boring machine.
Mortice machine, 5 spindle.
Sander, (disc and jig).
Sander, variety.
All belt sanders, including oscillating, No. 274, 3 overhead and 1 underneath.
6 in. jointer.
Double drum sander.
Cabinet benches.
Bow end bed clamp.
One No. 273 sander.
One case clamp.
One handy end clamp.
Electric glue pots.

Va., Richmond—Hackley Morrison Co., Inc., 1708-22 Lewis St., (machinery), G. W. Booth, Purch. Agt.—one 100 ton track scale, standard gauge; one ⅝ yd. caterpillar tread steam shovel; two $3\frac{7}{16}$ x 16 x 52 in. cast split pulleys, extra heavy, with key way and set screws.

Va., Wytheville—R. P. Johnson (machinery dealer), O. M. Johnson, Purch. Agt.—portable gasoline engine drive air compressor outfit, about 100 cu.ft. free air per minute (used); ⅝ yd. steam shovel, caterpillar tread.

Wash., College Place—Walla-Walla College—power press for printing college paper.

W. Va., Charleston—Tire Gauge Valve Co., H. D. Everett, Pres.—machinery and equipment for the manufacture of tire valves.

W. Va., Clifton—Clifton Coal Co.—coal tipple machinery, also conveying and handling equipment.

W. Va., New Cumberland — Hancock County Bd. Educ.—vocational equipment for $180,000 school at Weirton.

W. Va., Parkersburg—Blackwood Electric Steel Corp.—annealing furnaces, traveling crane, electric welders, air compressors, acetylene generator and grinders.

Wis., Chippewa Falls—Northern Supply Co. (telegraph and telephone supplies), J. M. Bischell, Mgr.—woodworking machinery and special machinery for the manufacture of poles, brackets, etc.

Wis., Green Bay — Fildex Corp. of America (manufacturer of filing cabinet devices), J. Kabat, Secy.s—pecial equipment and machinery, including precision tools.

Wis., Green Bay—Press Gazette, 315 Cherry St.—steel equipment and new press for proposed newspaper plant.

Wis., Madison—Piper Bros., 31 North Pinckney St.—refrigeration machinery.

Wis., Madison—M. Sommers, 512 West Wilson St.—refrigeration machinery.

Wis., Milwaukee—Luxknit Sweater Mills Co., 685 3rd St., P. E. Yolles, Purch. Agt.—power knitting machines.

Wis., Milwaukee—O. F. Pfeil, 2017 Clybourn St., (metal specialties)—nickle plating equipment and shafting.

Wis., Milwaukee—South Side Buick Co., 916 Forest Home Ave., J. A. Piszczek, Purch Agt.—presses, gas storage tank and pump.

Wis., Racine—B. R. Adams, 1010 18th St. (dairy)—ice making machinery, approximately 40 ton capacity.

Wis., Ripon—A. E. Wells—creamery equipment, including power churns, belting and shafting.

Wis., St. Francis—J. Handle, Station D, Route 1, (carpentry and millwork)—mortiser (used preferred).

Wis., Whitehall—E. F. Rotering (quarry) —crushing machinery.

Wis., Wisconsin Rapids—Arpin Process Coke Co., c/o J. B. Arpin—special machinery and equipment for the manufacture of coke.

B. C., Prince George—Aleza Lake Sawmill Co.—sawmill equipment.

N. S., Windsor—Nova Scotia Textiles, Ltd., (knit goods) — calender machine (used).

Ont., Alexandria — Alexandria Woolen Mills, Ltd., D. A. MacDonald, Pres.—two 108 in. blanket looms; one fancy loom with 25 sets harners or more; one automatic spinning mule; one bobbin winder to wind from the small bobbins as they come from the mule on to the bobbins to be used in the shuttles for the looms.

Ont., Arnprior—E. McKinney—cold storage and refrigeration machinery and equipment.

Ont., Hamilton — Ontario Shale Brick Co., Sun Life Bldg.—equipment for proposed plant.

Ont., Hamilton—Zimmerman Reliance Knitting Co.—$30,000 worth of additional equipment.

Ont., Milverton—West Window Regulator Co., E. H. Gropp, Mgr.—special metal working tools and machinery for the manufacture of patent auto window regulator.

Ont., Petrolea—Canadian Oil Co., C. A. Hale, Mgr.—equipment to replace that which was destroyed by fire.

Que., Montreal—Acme Trading Co., 205 St. James St., (pulp and paper), A. Ellison, Purch. Agt.—machinery for ground wood mill.

Que., Terrebonne — Limoge & Co., W. Limoge, Purch. Agt.—sash and door factory equipment, also woodworking and sawmill machinery.

Metal Working Shops

Calif., Berkeley—J. Havens, c/o J. W. Plachek, Archt., 2014 Shattuck Ave., is having plans prepared for the construction of a 1 story garage on Shattuck Ave. Cost will exceed $50,000.

Calif., Fresno—U. G. Hayden, Rowell Bldg., plans to build a 2 story battery station on Van Ness Ave. Estimated cost $20,000. Exide Battery Co., 1347 Van Ness Ave., lessee.

Calif., Fresno—The Herminghaus Estate plans to build a 1 story, 125 x 150 ft. garage on L St. between Merced and Tuolumne Sts. Estimated cost $40,000. Architect not selected. Waterman Bros., Tulare and L Sts., lessees.

Calif., San Francisco—G. Hackett, 247 Powell St., is having plans prepared for the construction of a 2 story (ultimately 6 story) garage and store building, on Ellis St., near Taylor St. Estimated cost $50,-000. O'Brien Bros., Inc., 240 Montgomery St., Archts.

Calif., San Francisco — The Stevenson Garage, Inc., c/o A. S. Bugbee, Archt., 26 Montgomery St., is having plans prepared for the construction of a 2 story, 130 x 150 ft. garage on Stevenson St.

Ill., Chicago—R. F. France, Archt., 155 North Clark St., is receiving bids for the construction of a 1 story, 106 x 135 ft. garage on Juneway Terrace near Clark St., for F. J. Fadner, c/o Architect. Estimated cost $125,000.

Ky., Louisville—The Louisville Garage is having plans prepared for the construction of a 2 story, 150 x 200 ft. garage on 5th Ave. Estimated cost $225,000. Murphy & Bros., Louisville Trust Bldg., Archts. Noted Dec. 14.

Ky., Ludlow—The Post-Glover Electric Co. plans to rebuild its factory for the manufacture of electrical devices, which was destroyed by fire. Estimated cost $25,000. Architect not announced.

Mass., Cambridge—The Ford Motor Co., Highland Park, Detroit, Mich., is having preliminary sketches made for the construction of a 3 story assembly plant with power house, here. Estimated cost $300,000. A. Kahn, 1000 Marquette Bldg., Detroit, Archt.

Mass., Holyoke—P. F. Donaghue, Walnut St., awarded the contract for the construction of a 2 story garage. Estimated cost $75,000.

Mass., Lawrence — The Champion-International Co., 38 Prospect St., paper makers, will build a 1 story, 65 x 115 ft. machine shop on Canal and Gorden Sts. Estimated cost $30,000. Noted Oct. 19.

Mich., Ecorse—The Michigan Steel Corp., 1708 1st Natl. Bldg., Detroit, has had plans prepared for the construction of six 1 story mills for the manufacture of sheet steel, on Rouge River, here. Estimated cost $1,000,-000. Private plans.

Mo., Kansas City—Holbert & Perrin, 23rd and Grand Sts., awarded the contract for the construction of a 2 story, 75 x 100 ft. garage on Armour Blvd. Estimated cost $42,000.

Mo., St. Louis—The Haynes-Langenberg Mfg. Co., 4045 Forest Park Blvd., awarded the contract for concrete work of 3 story, 150 x 200 ft. furnace factory on Bircher St. near Euclid Ave. Estimated cost $100,000. Noted Dec. 7.

Mo., St. Louis—The United Shoe Mchy. Corp., Albany Bldg., Boston, Mass., is having plans prepared for the construction of a 3 story, 125 x 190 ft. addition to its factory, for the manufacture of tacks and nails, at 4045 Forest Park Blvd., here. Architect not announced.

N. Y., New York—R. Jacobs, c/o R. H. Almiroty, Archt., 48 West 46th St., will soon receive bids for the construction of a 2 story, 100 x 100 ft. garage at 31 West 65th St. Estimated cost $50,000.

N. Y., Rochester — The Rochester Vulcanite Pavement Co., Sherman Pl., plans to build an addition to its plant, for the repair of machinery. Estimated cost $5,000. Architect not announced.

N. Y., Syracuse—Mills, Rhines, Bellman & Nordhoff, Archts., 1234 Ohio Bldg., Toledo, Ohio, are receiving bids for the construction of a 2 story, 100 x 250 ft. factory for the manufacture of gears for the New Process Gear Co., 500 Plum St., here. Estimated cost $150,000. C. R. Burt, Mgr.

O., Chillicothe—The Quartermaster General, Office War Dept., Wash., D. C., awarded the contract for the construction of a U. S. Veteran's Hospital, including garage and shop, and vocational shop, here. Estimated cost $1,497,000.

O., Cleveland—L. A. Lux Co., 2183 Scranton Rd. (boiler compound), awarded the contract for the construction of a 1 story, 40 x 80 ft. factory. Estimated cost $10,000. L. A. Lux, Pres.

O., Youngstown—The Brier Hill Steel Co., Stambaugh Bldg., plans to build a strip steel mill. Architect not announced.

Pa., Aspinwall (Pittsburgh P. O.)—Humes Bros., Brilliant St., awarded the contract for the construction of a 1 story addition to garage. Estimated cost $40,000.

Pa., Freedom — Freedom Oil Wks. awarded the contract for the construction of a 2 story, 48 x 75 ft. garage and repair shop addition to its plant. Estimated cost $40,000. Noted Aug. 3.

Pa., Lancaster—The Champion Blower & Forge Co. plans to build a 1 story, 60 x 145 ft. addition to its plant, to be used as an assembling department. Estimated cost $25,000. Architect not announced.

Pa., Leechburg—The West Leechburg Steel Co., Farmers Bank Bldg., Pittsburgh, awarded the contract for the construction of a 1 story, 120 x 700 ft. addition to its strip mill, here. Estimated cost $1,500,000.

Pa., Phila.—S. B. and B. W. Fletcher, 25th and Reed Sts., plan to build a 1 story, 60 x 160 ft. garage on 26th and Wharton Sts. Estimated cost $70,000. Stuckert & Co., Crozier Bldg., Archts.

Pa., Phila.—W. Smedley, Archt., Stephen Girard Bldg., is receiving bids for the construction of a 3 story, 102 x 104 ft. garage and repair shop at 223-27 Lombard St., for the Abbotts Dairy Co., c/o E. R. Linebach, 31st and Chestnut Sts. Estimated cost $150,000.

Pa., Pittsburgh—The Chatham Land Co., c/o H. D. Shawkey Motor Co., 5526 Penn Ave., awarded the contract for the construction of a 1 story, 100 x 200 ft. service and repair station on Penn Ave. and Pacific St. Estimated cost $60,000.

Pa., Pittsburgh—The Metal & Thermite Corp., 1201 Bway., New York City, awarded the contract for the construction of a 2 story, 40 x 100 ft. shop and storage building on Fayette St., here. Estimated cost $60,000. Noted Nov. 23.

Pa., Pittsburgh—The Natl. Metal Products Co., Erie and Diamond Sts., will build a 1 story, 68 x 138 ft. factory on Chateau and Fayette Sts. Estimated cost $60,000.

Pa., Pittsburgh — The Studebaker Sales Co., 4724 Baum Blvd., awarded the contract for the construction of a 2 story, 87 x 112 ft. addition to its garage and sales room. Estimated cost $65,000. Noted Nov. 16.

Pa., Pittsburgh—The Van Vleck Motor Car Co., 420 North Craig St., will soon award the contract for the construction of a 3 story, 91 x 115 ft. automobile sales and service station on Baum Blvd. and Commerce Way. Estimated cost $125,000. E. P. Mellon, 350 Madison Ave., New York City, Archt.

Pa., Wilkinsburg (Pittsburgh P. O.)—C. C. McKallip, Magee Bldg., Pittsburgh, is receiving bids for the construction of a 2 story, 50 x 90 ft. sales room and garage on Penn Ave., here. Estimated cost $50,-000. Private plans.

R. I., East Providence—The United Electric Rys. Co., Providence, is receiving bids for the construction of a 1 and 2 story, 170 x 535 ft. car house and repair shop on North Bway, here. Estimated cost $400,000. Private plans.

W. Va., Warwood (Wheeling P. O.)—The Centre Fdry. and Machine Co. awarded the contract for the construction of a 1 story, 100 x 320 ft. foundry and machine shop. Cost will exceed $60,000.

Wis., Cambridge—A. Kiavick plans to build a 1 and 2 story, 50 x 90 ft. garage, repair shop and filling station on Main St. Estimated cost $45,000. Architect not selected.

Wis., Sheboygan Falls—The Falls Motor Corp. is receiving bids for the construction of a 1 story, 50 x 60 ft. factory for the manufacture of motors.

Wis., Stratford—G. Chrouser plans to build a 2 story, 60 x 100 ft. garage and repair shop. Estimated cost $40,000. Architect not selected.

Wis., Waukesha—The Spring City Auto Co., 220 West Main St., awarded the contract for the construction of a 1 story, 65 x 190 ft. garage. Estimated cost $40,000. Noted Dec. 7.

Ont., Mount Dennis — The Electroplax Mfg. Co. plans to rebuild its electro plating factory which was recently destroyed by fire. Estimated cost $100,000.

Ont., Toronto—C. Pearce, 100 Inglewood Dr., plans to build a 1 story, 40 x 120 ft. garage. Estimated cost $25,000.

General Manufacturing

Ala., Montgomery—The Atlantic Ice & Coal Co., Perry St., awarded the contract for the construction of a 101 x 220 ft. ice and cold storage plant. Estimated cost $300,000.

Calif., Berkeley—L. W. Hink, 2226 Atherton St., is having plans prepared for the construction of a 2 story garage and printing plant. Estimated cost $15,000. J. W. Plachek, 2014 Shattuck Ave., Archt.

Calif., Emeryville—The Paraffine Co.'s, Inc., 34 1st St., San Francisco, manufacturer of box board, roofing, wall board and floor coverings, has purchased a 40 acre site, here, and plans to build extensions to its plant.

Calif., San Francisco — The California Shade Cloth Co., Inc., 2183 Bryant St., has had plans prepared for the construction of a 2 story, 40 x 200 ft. factory on San Bruno Ave. near Costa St. Estimated cost $35,000. Private plans.

Calif., San Francisco—Roth, Winter & Walsh, 1271 Mission St., pork packers, have had plans prepared for the construction of a 2 story, 92 x 120 ft. packing plant on Townsend St. near 5th St. Ward & Blohme, 454 California St., Archts.

Calif., Stockton—The Natl. Paper Products Co., Church St., between McDougall and Stockton Sts., awarded the contract for the construction of an addition to its paper mill. Cost between $100,000 and $150,000.

Conn., South Norwalk—H. Jacobs & Sons, Day St., are receiving bids for the construction of a 2 story, 60 x 120 ft. addition to shoe factory. Estimated cost $40,000. A. S. Meloy, 2965 Main St., Stratford, Archt.

Conn., Waterbury—R. F. Worden & Sons, Cherry St., awarded the contract for the construction of a 3 story, 40 x 45 ft. addition to their factory, for the manufacture of novelties. Estimated cost $25,000.

Conn., Westport — Lees Mfg. Co., 320 Bway., New York City, awarded the contract for the construction of a 3 story, 50 x 150 ft. addition to its cordage and twine factory, here. Estimated cost $75,000. Noted Dec. 14.

Del., Clayton—J. A. Bader & Co., 923 Market St., Wilmington, awarded the contract for the construction of a 1 story, 75 x 100 ft. ice manufacturing plant, here. Estimated cost $30,000.

Idaho, Weippe—E. T. Chapin Co., Symons Bldg., Spokane, Wash., manufacturer of poles, will receive bids in the spring for the construction of a sawmill, here. Estimated cost $100,000.

Ill., Chicago—The Advertising Art Bulletin Co., 190 North State St., is having plans prepared for the construction of a 1 and 2 story, 163 x 239 ft. factory on Ravenswood St. near Peterson St. Estimated cost $100,000. A. H. Knox, 7 West Madison St., Archt.

Ill., Chicago—The Evans Fibre Box Co., 3261 West 47th St., awarded the contract for the construction of a 1 and 2 story, 101 x 483 ft. factory at 4734-60 South Spaulding Ave. Estimated cost $150,000.

Ill., Chicago — The E. L. Mansure Co., 1601 Indiana Ave., manufacturer of draperies and trimmings, plans to build an 8 story factory and office building. Estimated cost $2,000,000. Architect's name withheld.

Ill., Dixon—O. Beyer, Hennepin and 1st Sts., will soon receive bids for the construction of a 1 and 2 story, 79 x 140 ft. bakery. Estimated cost $90,000. R. Griesser, 64 West Randolph St., Archt.

Ill., Taylorville—The Hopper Paper Co. is receiving bids during December for the construction of a 2 story, 80 x 160 ft. addition to its factory. Estimated cost $60,000. Billingham & Cobb, 404 Press Bldg., Kalamazoo, Mich., Archts.

Ind., Fort Wayne — The Fort Wayne Dairy Co., 449 Baker St., awarded the contract for the construction of a 2 story dairy. Estimated cost $50,000.

Ind., Fort Wayne—The Standard Lumber & Supply Co., Leesburg Rd., is having plans prepared for the construction of a 2 story, 50 x 100 ft. planing mill and garage. Estimated cost $25,000. Private plans.

Kan., Wichita—The Jacob Dodd Packing Co., 21st St. and Lawrence Ave., awarded the contract for the construction of a refrigeration plant. Estimated cost $100,000.

Kan., Wichita — L. A. Watkins, North Waco St., will soon receive bids for the construction of a 1 story, 50 x 140 ft. planing mill. Estimated cost $12,000. U. G. Charles, 2601 Schweiter Bldg., Engr. and Archt.

Ky., Louisville — A. Loomis, Archt., 51 Todd Bldg., will receive bids in the spring for the construction of a 3 story, 100 x 220 ft. printing plant on 9th St. and Bway. for the Gibbs-Inman Co., 825 West Bway. Estimated cost $100,000.

Mass., Bridgewater—L. Q. White Shoe Co. is having plans prepared for the construction of a 5 story, 40 x 300 ft. factory. Estimated cost $50,000. Architect not announced.

Mass., Clinton—Roubaix Mills, Inc., 792 Main St., awarded the contract for the construction of a 2 and 3 story dyehouse, to contain 15,000 sq.ft. of floor space on Main St. Estimated cost $50,000.

Mass., Great Barrington — The Dairymen's League Co-operative Association plans to build a 2 story dairy. Estimated cost $50,000. Architect not announced.

Mass., Marlboro — The Marlboro Dairy Co. awarded the contract for the construction of a 2 story, 50 x 60 ft. dairy on East Main St. Estimated cost $50,000.

Mass., Quincy (Boston P. O.)—Brooks-Skinner Co., Inc., Quincy Point, will build a 1 story, 100 x 242 ft. factory for the manufacture of portable buildings, here. Estimated cost $50,000.

Mass., Roxbury (Boston P. O.) — The Armstrong Knitting Mills, 99 Chauncy St., awarded the contract for the construction of a 2 story, 40 x 60 ft. addition to knitting mill, here. Estimated cost $15,000.

Mass., South Boston — The New York, New Haven & Hartford R.R. Co., South Station, Boston, awarded the contract for the construction of a 1 story roundhouse, etc., on Dorchester Ave., here. Estimated cost $75,000.

Mass., Spencer—The Spencer Gas Co., 110 Main St., will alter and build a 1 story addition to its gas plant on Elm St. Cost between $40,000 and $50,000.

Mass., Stoneham—The J. J. Grover Sons Co., Main St., will build a 4 story, 40 x 80 ft. addition to its shoe factory. Estimated cost $40,000.

Mass., Waltham—The New England Coal Co., Newton St., will build a coaling plant. Estimated cost $25,000.

Mich., Petoskey—The Petoskey Portland Cement Co. is having preliminary plans prepared for extending factory, stock house and power plant. Estimated cost $500,000. J. C. Buckbee, 1st Natl. Bank Bldg., Chicago, Engr. This corrects report in Dec. 7 issue.

Mich., River Rouge—Ford Motor Co., Highland Park, awarded the contract for the construction of a 260 x 365 ft. plate glass and gas producer plant, here. Estimated cost $1,500,000.

Mich., River Rouge (Branch of Detroit) —A. Kahn, Engr. and Archt., 1000 Marquette Bldg., Detroit, is receiving bids and will open same about Dec. 29 for the construction of a 1 and 2 story, 150 x 300 ft. cement plant, including conveyor runway in open clinker storage adjoining coal grinding and calcining building, and 10 silo storage bins for bulk cement, 24 ft. in diameter, here, for the Ford Motor Co., Highland Park, (Branch of Detroit).

Minn., Hibbing—The Members of Village Council will soon award the contract for the construction of a 1 story, 65 x 65 ft. gas works. Estimated cost $30,000. C. Foster, 512 Sellwood Bldg., Duluth, Engr. and Archt.

Mo., Kansas City—Hall Bros. Co., 1114 Grand Ave., manufacturer of stationery, etc., awarded the contract for the construction of a 5 story, 100 x 115 ft. plant on 26th and Walnut Sts. Estimated cost $1,250,000.

Mo., Kansas City—The Kansas City Oxygen Gas Co., 1805 Grand Ave., is having plans prepared for the construction of a 2 story, 18 x 48 ft. factory on 13th and Easton Sts. Estimated cost $25,000. Private plans.

Mo., St. Louis—The Grace Sign Mfg. Co., 425 South Main St., awarded the contract for the construction of a 1 story, 162 x 260 ft. sign factory on President and 2nd Sts. Estimated cost $100,000. Noted Dec. 14.

N. J., Camden—H. Kohnstamm & Co., Cleveland and Lois Sts., plan to build a 1 story, 65 x 74 ft. factory for the manufacture of laundry supplies. Estimated cost $18,000. Private plans.

N. J., Trenton—The New Jersey Porcelain Co., New York Ave. and Mulberry St., plans to build a plant. Architect not selected.

N. J., Trenton — The Trenton Potteries Co. will build a 1 story, 50 x 150 ft. kiln building at the Equitable Pottery plant on Lalor and Hancock Sts. Estimated cost $10,000.

N. J., West Berlin—Baccelleri Bros., 924 South 11th St., is receiving bids for the construction of a 1 story, 50 x 150 ft. furniture factory. Estimated cost $35,000. Private plans.

N. Y., Buffalo—The Culliton Ice Cream Co., 172 Guilford St., has had plans prepared for the construction of a 20 x 65 x 80 ft. ice plant, a 15 x 30 x 65 ft. engine room and a 12 x 30 x 60 ft. ice storage building on East Jewett Ave. Cost will exceed $25,000. Architect's name withheld.

N. Y., Buffalo—Kittinger Bros., 1893 Elmwood Ave., plans to build a large addition to furniture factory. Estimated cost $40,000. Architect not announced.

N. Y., Buffalo—The Quality Damp Wash Co., Inc., Northland Ave. and Chelsea St., plans to build a 1 story, 80 x 100 ft. laundry. Architect not announced.

N. Y., Buffalo—The Sinclair Oil Co., Washington St., plans to rebuild major portion of its gasoline and oil plant on Alabama St., which was destroyed by fire. Estimated cost $100,000. Architect not announced.

N. Y., Cohocton—The Wetmiller Dairy & Farm Products Co. awarded the contract for the construction of a 2 story, 44 x 44 ft. dairy.

N. Y., Dundee—W. Fox plans to rebuild flour and feed mill on Vine St. which was destroyed by fire. Estimated cost $5,000. Architect not announced.

N. Y., Hornell—The Elmhurst Dairy Co. plans to build a creamery on Erie Ave. Estimated cost $10,000. Architect not announced.

N. Y., Jamestown — The Jamestown Worsted Mills Co. awarded the contract for the construction of factory No. 16, 4 story, 70 x 180 ft. Estimated cost $250,000. Noted Nov. 16.

N. Y., Mayville—The Chautauqua Cabinet Co. plans to build an addition to its factory for the manufacture of wooden cabinets. Cost will exceed $6,000. Architect not announced.

N. Y., Niagara Falls—The A. S. Gilman Printinñ Co., 623 St. Clair Ave., awarded the contract for the construction of a 1 story, 100 x 200 ft. printing plant.

N. Y., Rochester—The Empire State Ice Co., 76 West Monroe St., Chicago, has had plans prepared for the construction of a 48 x 182 ft. and 67 x 133 ft. ice plant on Atlantic Ave., here. Estimated cost $300,000. Private plans.

N. Y., Tonawanda—The American Kardex Co., Main St., is having plans prepared for the construction of a 2 story, 50 x 160 ft. addition to its plant. Estimated cost $70,000. L. Eggert, 35 Elmwood Ave., Archt.

N. C., Gastonia—H. H. Groves will soon award the contract for the construction of a cotton mill for the manufacture of fine combed yarns, capacity 15,000 spindles.

N. C., Whitnel—The Nelson Cotton Mill Co., Lenoir, plans to build a 6,000 spindle cotton mill, here.

O., Cleveland—Donley Bros., Co., East 74th St. and Aetna Rd., (building specialties) plans to build a 1 story factory on East 138th St. and Miles Ave. Estimated cost $50,000. G. Donley, Mgr. Architect not selected.

O., Cleveland—The Double Eagle Bottling Co., 6517 St. Clair Ave., awarded the contract for the construction of a 2 story, 30 x 60 ft. bottling works. Estimated cost $40,000. J. Potokar, Mgr. Noted Nov. 16.

O., Cleveland—Fischer & Jirouch, 4821 Superior Ave., awarded the contract for the construction of a 3 story, 60 x 73 ft. addition to plastic works. Estimated cost $40,000.

Ore., Medford — W. E. Sterns plans to build a cold storage plant.

Ore., Portland—The See-Der Mfg. Co., Larabee and Delay Sts., plans to build a factory for the manufacture of cedar chests, furniture and wood novelties. Estimated cost $25,000.

Pa., Allentown—The Independent Oil Co., Inc., Rialto Bldg., plans to rebuild its oil plant on 12th St., which was destroyed by fire. Cost between $60,000 and $75,000. Architect not announced.

Pa., Johnstown — The Edward Hahn Packing Co., Hickory St., awarded the contract for the construction of a 3 story, 48 x 108 ft. and 24 x 112 ft. addition to its packing plant. Estimated cost $65,000. Noted Dec. 7.

Pa., Pittsburgh—The Ward Baking Co., Southern Blvd. and St. Marys St., New York City, will soon award the contract for the construction of a 1 story, 141 x 194 ft. addition to its bakery on Penn Ave., Beechwood Blvd. and Shakespeare Alley, here. Estimated cost $100,000. C. B. Comstock, 110-112 West 40th St., New York City, Archt.

Pa., Tullytown — The Megargee Paper Mills, 16 South 6th St., Phila., will not build a paper plant, here, as stated in issue of Dec. 7.

Pa., Wilkes-Barre — A. Hildebrand, 91 Wood St., plans to rebuild planing and lumber mill which was destroyed by fire. Estimated cost $45,000. Architect not announced.

Wash., Hoquiam — The Grays Harbor Home Building Corp. is building a plant for the manufacture of ready cut homes and buildings. C. Kane, Secy.

Wis., Cedar Grove — The Cedar Grove Shoe Mfg. Co. plans to build a 2 story, 50 x 95 ft. shoe factory. M. J. De Master, Pres. Architect not selected.

Wis., Green Bay—The Northern Paper Mills, Day St., manufacturer of machinery to bark logs, will build a 1 story, 40 x 100 ft. barker room. Estimated cost $12,000.

Wis., La Crosse—The Art Glass Co., 125 South Front St., awarded the contract for the construction of a 1 story, 40 x 100 ft. factory for the manufacture of art glass, on South 3rd St. Estimated cost $25,000. F. H. Flemmer, Mgr.

Wis., Madison — Heilprin & Co., West Mifflin St., is having plans prepared for the construction of a 2 story, 75 x 150 ft. cold storage warehouse on Bedford St. Estimated cost $90,000. J. Heilprin, Pres. E. A. Tough, Conklin Bldg., Archt. Noted Nov. 30.

Wis., Milwaukee—H. J. Esser, Archt., 82 Wisconsin St., is receiving bids for the construction of a 2 story, 85 x 150 ft. dairy on 11th St. for the Cedarburg Dairy Co., c/o H. Berns, 1586 Prospect Ave. Estimated cost $75,000. Noted Nov. 30.

Wis., Milwaukee—The Harsh & Chapline Shoe Co., 694 Hanover St., awarded the contract for the construction of a 3 story, 60 x 210 ft. factory. Estimated cost $110,000. Noted Nov. 30.

Wis., Sheboygan—The city is receiving bids for the construction of a 2 story, 76 x 108 ft. tool, carpenter and woodworking shop, on South Water St. Estimated cost $40,000. J. Steimle, Clk. A. A. Nack, City Hall, Archt.

Wis., Sturgeon Bay—The Door County Fruit Growers Union plans to build a cold storage plant and a dehydrating plant for drying apples. Estimated cost $50,000. E. L. Johnson, Mgr. Architect not selected.

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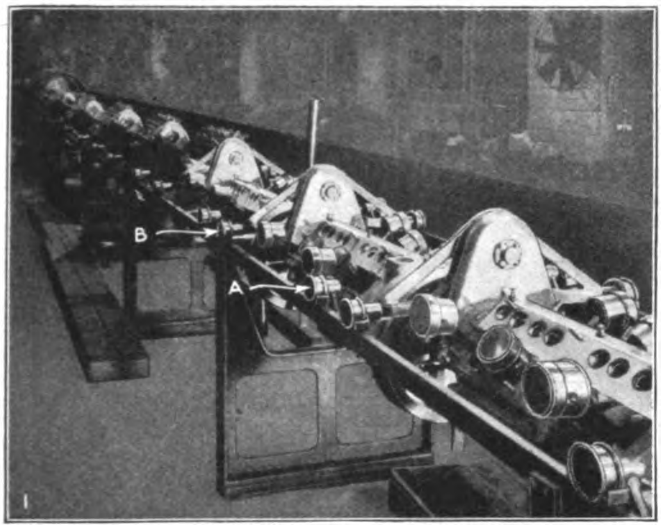
Assembling, Testing and Storing Motors

Using Small Trucks or Casters, Elevated Tracks, Roll-over Frames, Transfer Tables, Overhead Carriers and Elevators for Storing in Tiers

BY FRED H. COLVIN
Editor, *American Machinist*



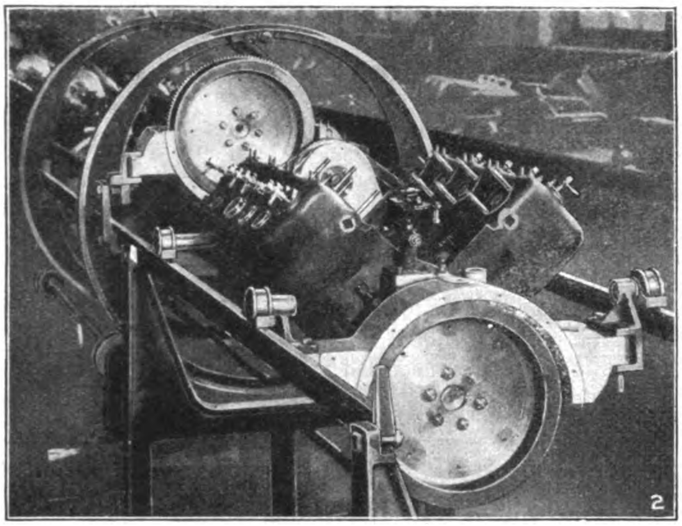
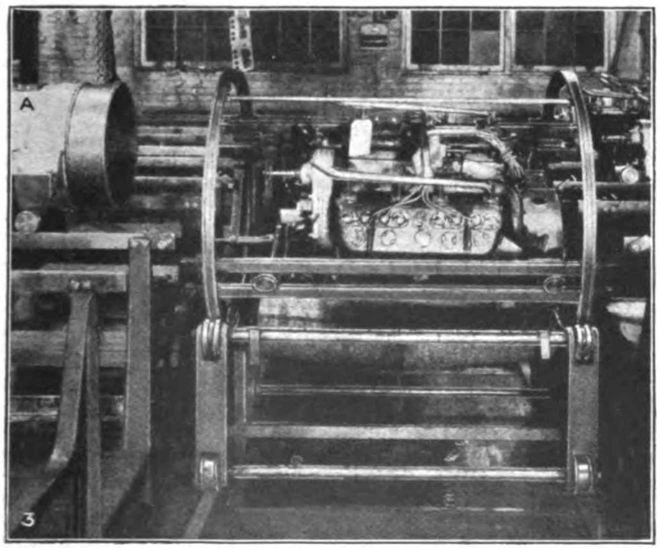


FIG. 1—ASSEMBLING TRACK FOR MOTORS. FIG. 2—ROLL-OVER FRAME AND TRANSFER TABLE

THE way in which the Peerless Motor Car Co. handles its motors, both in assembling, in testing and in storing for future demand, presents a number of problems and their solution. The various methods used are well worth studying from a number of different angles, as parts if not all of the system can be used in many places.

In Fig. 1 is shown a portion of the line of elevated track on which the motors are, for the most part, assembled. It will be noted that each crankcase has four small caster or truck wheels. Two wheels as at *A* are bolted to the case, utilizing the same bolt holes as for fastening the motor to the frame. The other two wheels, as at *B*, are mounted on a frame which bolts to the front of the case. When the front cover is put on, the frame carrying the wheels at *B* is removed and wheels, as at *A*, are bolted to the case. The track holds the motor at a convenient working height and permits it to be easily moved down the line as the assembling progresses. As shown, the crankshaft and connecting



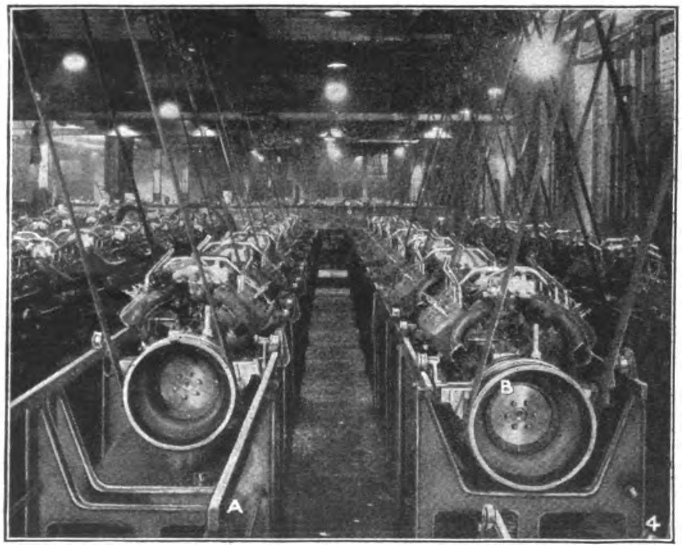
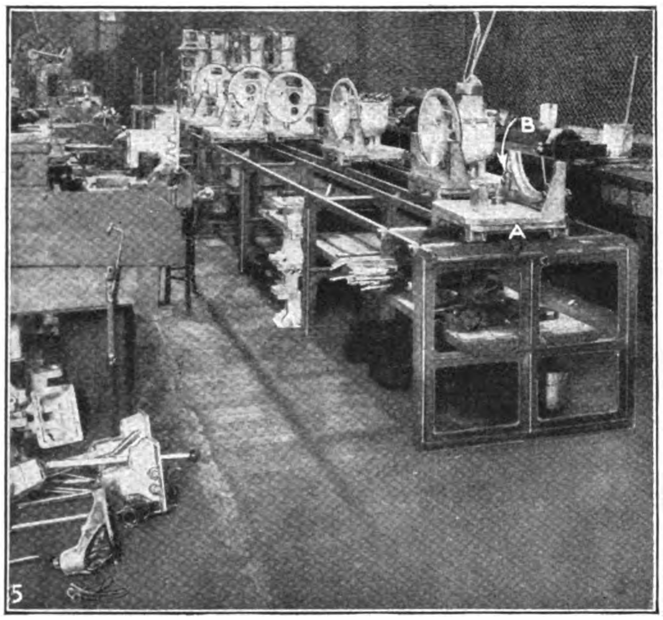


FIG. 3—TRANSFER BETWEEN TWO LINES OF TRACKS. FIG. 4—PART OF THE RUNNING-IN STANDS



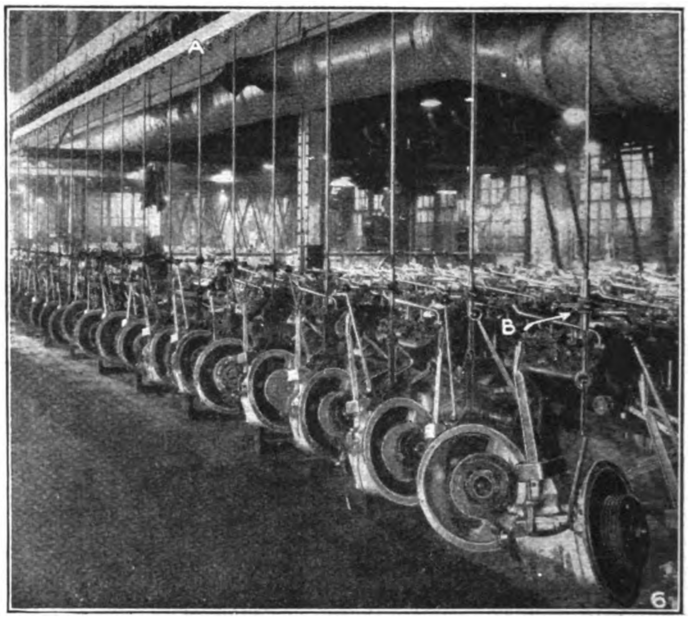


FIG. 5—THE TRANSMISSION ASSEMBLY. FIG. 6—BRINGING THE TRANSMISSION TO THE MOTORS

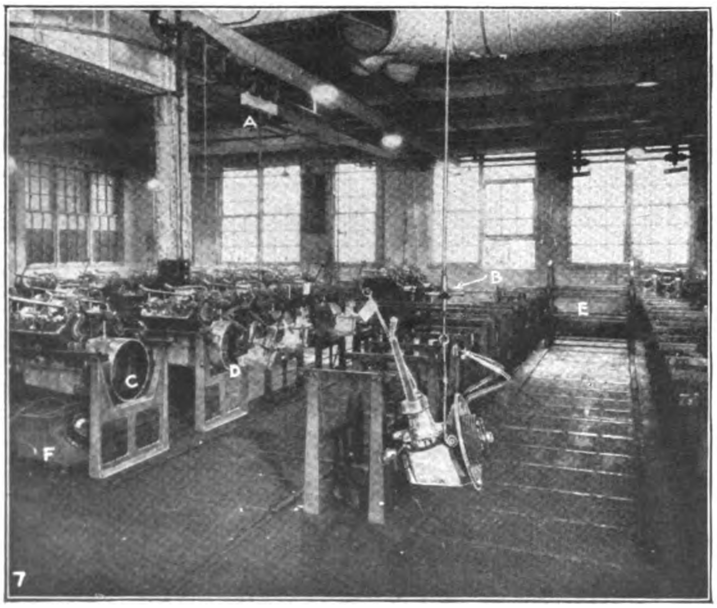
rods are in place and the case is ready for the cylinders, manifolds, and other parts.

A motor, practically completed, is shown in Fig. 2, and immediately ahead of it is a roll-over frame for turning the motor upside down or putting on the lower crankcase as well as inspection or adjustments. This frame is shown in detail in Fig. 3. It will be seen in this illustration that the roll-over frame is mounted on small wheels on a cross track so that it acts as a transfer table by which a motor can be taken from any one of the assembly lines and transferred to any other line on either side of the transfer track. A motor is shown upside down at *A*.

There are also plain transfer trucks, as at *A* Fig. 4, which are used when it is not necessary to turn a motor over. This view also shows part of the running-in stands. The capacity of this department, however, can hardly be judged from the illustration. The motors are run in by belts from the overhead countershafts, each countershaft being supplied with a friction clutch. It will be noted that each motor is provided with a suitable pan, drawn deep in the center, for catching any oil drip which may work out of the motor during the running-in process. A special, light pulley is bolted to the flywheel, as shown at *B*, and is used for running-in the required 20 hr. at 250 r.p.m. The motor is then torn down and all wearing parts inspected. After reassembly it is run 10 hr. at the same speed as before and then goes to final test under its own power.

Assembling the Transmission

In the meantime, the transmission units are being assembled, a portion of this department being shown in Fig. 5. Special frames are provided as at *A*, mounted on small wheels which fit the tracks at the top of the assembling benches. The clamps, shown at *B*, hold the transmission case in place during assembly. As the transmissions are completed they are suspended from a series of overhead carriers, as shown in Fig. 6. Each of these carriers consists of a bar carrying four flanged wheels and these fit over and run on a T-shaped runway suspended from the roof girder. These wheels come up



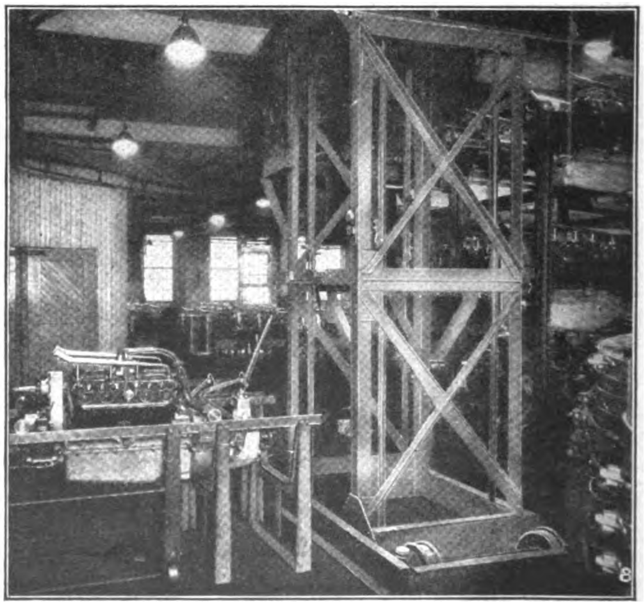


FIG. 7—PUTTING TRANSMISSIONS ON MOTORS. FIG. 8—ELEVATOR FOR TIERING MOTORS

on each side of the rail and rest on the T-head, being spaced far enough apart to clear the supporting hangers.

Each carrier bar *A* has a long rod through the center, fitted with a four spoked right and left nut which acts as a turnbuckle as at *B*. Below the turnbuckle is a short rod and suitable hooks for lifting the transmission and suspending it during transit from the assembling department. One of these carriers is shown more clearly in Fig. 7 where the transmission has reached the motor for assembly, after the running-in has been completed. This view shows both the carrier *A* and turnbuckle *B* quite plainly and gives a better appreciation of the convenience of the arrangement. The turnbuckle facilitates raising the transmission to line up with the motor. At *C* is a motor which still has the running-in pulley in place, at *D* the transmisson is swung into place for final assembly. Here we see the assembly tracks, showing where the transmissions come into the progressive assembly, and the roll-over frame at *E*. At *F* is a battery and ammeter for testing starting motors.

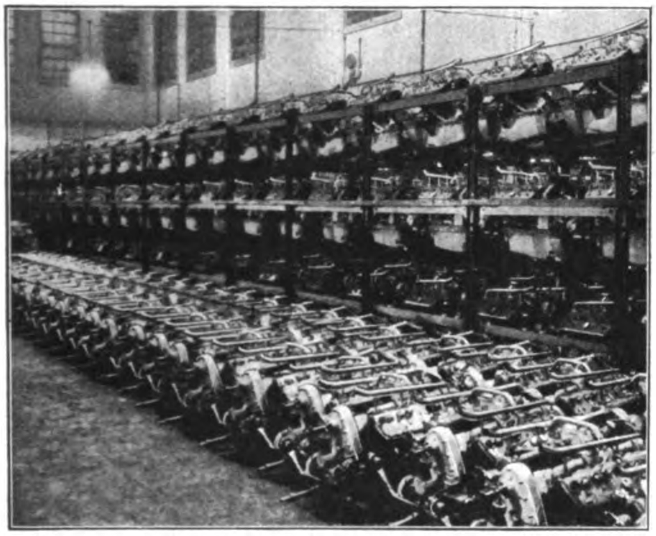


FIG. 9—COMPLETED MOTOR STORAGE

It runs on a small track to reach every line of the assembly tracks.

Storing Completed Motors

Motors are usually made up in advance of assembly into the chassis and it is necessary to store them safely and compactly. For this purpose, a sort of elevator known as a tiering machine is used and is shown in Fig. 8. This is a self-contained elevator built with a steel frame and mounted on fair-sized, flanged wheels which fit on a track running crosswise of the storage tracks. In other words, it is a combined elevator and transfer table. The elevator car is merely a pair of rails which correspond to the assembling tracks already shown, and the completed motor can be run on the elevator, hoisted to the desired level, the whole elevator moved sideways if necessary, and the motor run to any storage track desired.

The motor storage racks, which consist of three tiers of tracks, are shown in Fig. 9. This view also shows the racks full and a fair sized surplus on the floor beside them. This condition, however, is not general, the racks being built to accommodate the usual number of motors stored. These racks keep the motors safely and out of the way but readily available for assembly whenever needed. With minor modifications, such a system can be adapted to many other kinds of manufacturing.

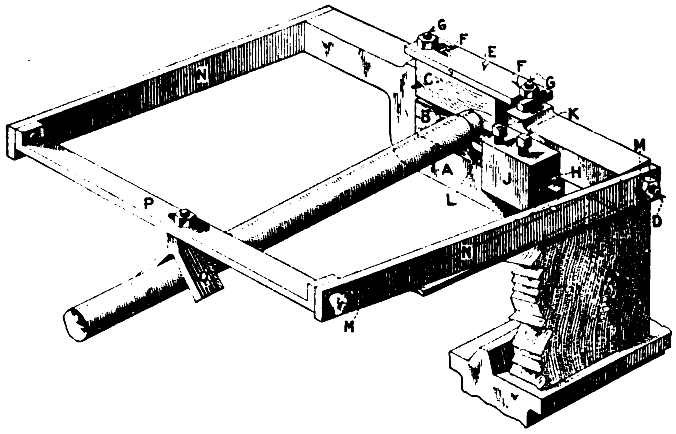
Turning Long Shafts in a Short Lathe

By Edward Heller

Mr. E. W. Tate's article, Re-Echoes from the Oil Country, in the *American Machinist*, Vol. 56, No. 26, reminds me of a method we used for turning long shafts in a famous textile town in Russia. While Mr. Tate's description is of a stunt used in an exceptional case, the method and tools that will be described here are of a kind that were used every day as a regular feature.

The shop where this method was employed had a gap lathe that swung about 14 in. over the carriage and about 3 ft. in the gap but would take only about 6 ft. between centers and that, of course, would not do for 20 ft. or longer shafts. Now, at that time and in that part of the world, we did not know anything about cold rolled shafting as it is manufactured now in all sizes coming within a few thousandths on the diameter and running pretty true in general. The material we got there was black hot-rolled stuff, not very close to any standard size, with bends and kinks that took quite a bit of ingenuity to take out. When a shaft like this was to be used for a transmission shaft, it had to be turned the whole length to a size in order to fit pulleys. And here is how it was done on that short lathe.

The lathe had a wooden bed extension that was as long as our shop permitted. This bed was securely bolted to the lathe bed and lined up nicely with the real lathe. When a long shaft had to be turned the tail stock was moved out on the extension as far as necessary and clamped down with a special bolt and strap. The shaft was then centered with a punch, tried on the centers for accuracy, and when everything looked O. K. it was drilled and countersunk with a home-made drill and countersink held in a peculiar sort of breast drill that must have been brought over on the Ark. As soon as the shaft had substantial centers, it was put in the lathe with a dog on one end and was given a general survey to



DEVICE FOR TURNING LONG SHAFTS IN A SHORT LATHE

see how many "cranks" and kinks it possessed. All the big kinks were then hammered out with a sledge on an anvil that was brought to the lathe, while the minor bends were sprung out straight with a bar, right in the centers.

When the shaft was straight enough to clean up with the cut, it was blocked up in the middle to take the sag out, the dog was fastened as close as possible to the driving end and a piece four or five inches long was turned to size with a tool that left *good sharp tool marks.*

The shaft was now turned, end for end, so that the finished piece was at the tail stock and the device shown in the accompanying illustration was used to turn the rest of the shaft.

This turning device consisted of a cast iron saddle *A*, with studs *D* and *G* screwed in at the places shown and carrying hardwood blocks *B* and *C*. These blocks had a hole bored out to suit the finished size of the shaft and it was so located as to leave not more than one quarter of an inch wall on the front side of the blocks. In other words, the hole was off center in all cases excepting when a shaft of the full capacity of the fixture was turned. The lower block *B* was lined with tin for reasons that will be explained later. On one side of the saddle *A* was a box affair *J* which was provided with stout set screws *K* and *H*, the former for holding the tool *L* down in place and the latter for holding it in and adjusting the cut.

The saddle *A* holding the lower block *B* was placed under the shaft, the upper block *C* was then put in and the whole thing clamped by means of the nuts *F* clamping down the latch bar *E*. The links *N*, *N*, carrying the cross bar *P* and the V-block *Q* were then added, the front end of the saddle *A* was blocked up to prevent it from turning and the lathe was started. As soon as the lathe was in motion the nuts *F* were pulled up snugly so that the shaft could just go around without undue friction and the tool *L* was brought to the work and made fast. The wooden blocks would immediately wear themselves into the tool marks made on the finished piece on the shaft and begin to feed the whole business toward the head stock. The cutting point on tool *L* would usually be an exact duplicate of the tool used in the tool post in the carriage, so that there would be no perceptible stop between the two finishes and it would provide its own means of feeding as it went along.

Making the Job Run Itself

After the outfit moved over its own length the nuts *M*, *M*, *M*, *M*, were released and the links *N*, *N*, and cross bar *P* with V-block *Q* would be thrown over to the back. Then the V-block running over the finished shaft would take off some of the strain from the comparatively short blocks *B* and *C*, and the job went merrily along until the tool box *J* reached the dog at the head end of the lathe. While this turning operation did not complete the job it certainly did most of the work and with very little attention.

A can full of oil with a dripping arrangement was kept over the tool point and the excess oil went to the wooden feed bearing. One of the apprentice boys (and the writer was one of them) was generally delegated to keep the can full, and occasionally tighten the nuts *F* to take up the wear on the upper block *C*. The lower one being lined with tin would usually last throughout the whole trip. The reason for the tin lining was to preserve as much as possible the setting, since the cutting tool *L* was practically integral with the lower block while it did not matter how much the upper block wore out.

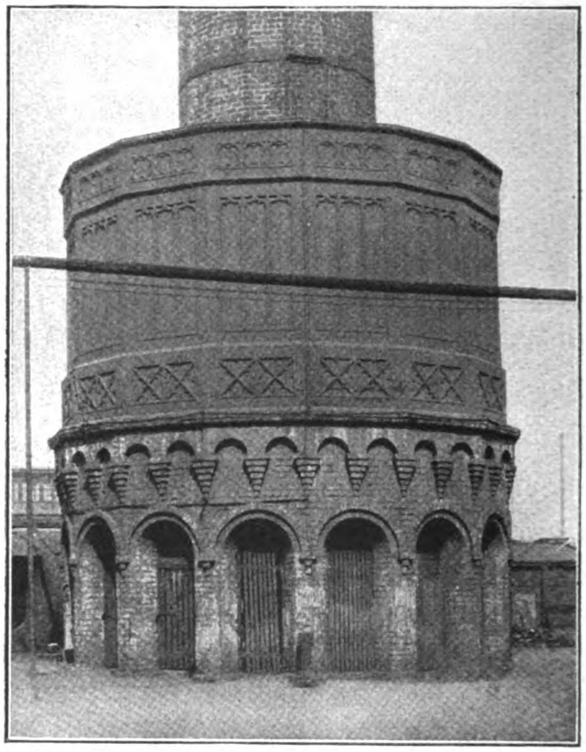
Keeping the wooden block at the right pressure was comparatively easy. All that was necessary to do was to watch the "motor." In our case it consisted of a human being turning a crank somewhere in a corner of the shop from which emerged a belt to an overhead shaft carrying the cone pulley for our lathe. As it was the duty of the apprentice boy to help the "motor" along occasionally he could feel very quickly when the feed mechanism was getting loose, while, on the other hand, a grunt issuing from the power plant would be evidence that the wrench was pulled a little too far.

To finish the shaft the carriage was dismantled, the apron and gibs taken off and what was left was put on the wooden bed close to the tail stock and fastened down with special clamps. The work was then finished by using the compound rest. After the ends were turned and fitted to couplings, the shaft while running at high speed (i.e. at as high a speed as could be drawn out from our "motor") was first filed to size to a ring, then the couplings were driven on, keyed and faced in the centers on the shaft. When all this was done the shaft was polished with oil and emery and was ready to be "hung."

A Peculiar Water Tank

By A. B. Seaman

The water tank shown supported on brick work and surrounding the chimney base in the accompanying illustration is built of cast-iron segments bolted together. The tank was built in 1853 and has never been known to leak. The original purpose of the tank was to supply water to the Savannah shops of the Central of Georgia Railway. The brickwork supporting



TANK SURROUNDING A CHIMNEY

the tank originally inclosed the shop toilets, but the space under the tank is now used for storage.

The chimney, built at the same time as the tank, is about 150 ft. high, and is lined with fire brick the entire height. The foundation of brick and mortar is laid to a depth of 15 ft. below the ground level. The chimney is bell-mouthed at the top and the thickness of the brickwork at that point is almost 6 feet.

The chimney has been struck by lightning many times without further damage than having a few bricks knocked off. Owing to its age and possible deterioration it was banded at intervals of about 15 ft. ten years ago. One of the lower bands can be seen just above the top of the tank.

Making Steel Balls

Conclusion of Article on Atlas Ball Company Methods—Methods of Hardening Large and Small Balls—Lapping, Finish Grinding and Polishing

BY A. L. DE LEEUW
Consulting Editor, *American Machinist*

AFTER soft grinding the balls are hardened. This is done in an automatic furnace which is shown in Fig. 10. A few shovelfuls of balls are thrown in the front end of the furnace which, as will be noticed, rotates around its axis. The interior of this furnace is provided with a helical pathway which extends the entire length with the exception of the front end where the loading is done. A scoop or projection of the rotating compartment gathers up a few of the balls and when the rotation of the machine has brought the scoop to the proper position it discharges these balls into the helical groove which they must follow from then on.

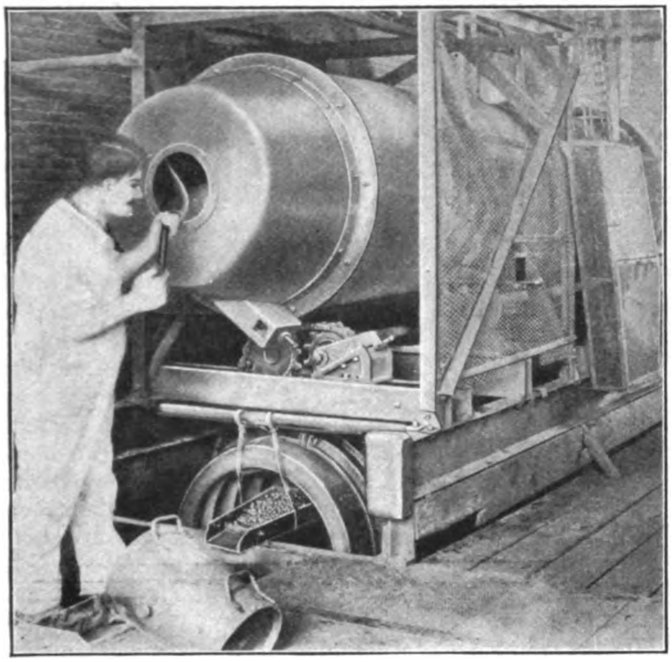


FIG. 10—ROTATING HARDENING FURNACE, AND ROTATING QUENCHING DRUM

The furnace is centrally heated at the far end and the speed is so arranged that the balls are brought to the proper hardening temperature when they have reached that end. They are then automatically discharged through a pipe into the center of another barrel shaped piece of apparatus which may be seen in the illustration, half-way projecting above the floor. The lower barrel is submerged in a large body of water which is constantly renewed by a pump so that its temperature remains practically constant throughout the day. It also has a helical pathway which brings the balls back to the loading side.

The illustration shows clearly how the balls are discharged into a tray, where they are prevented from rolling out by a block of wood. The operator picks one of these balls up every so often and cracks it to observe the fracture. A secondary operation which may be considered properly to belong to the hardening is the tempering. Balls are tempered at a very low temperature, never exceeding 300 degrees F. The smaller balls are tempered in hot water, the larger ones in hot oil. This system of hardening produces very uniform results.

The very largest balls, however, are hardened in a furnace with proper temperature control. The main things to observe with the system of hardening in the rotary furnace are the time and temperature, and both these items are of equal importance. Time is regulated by varying the speed of the driving motors while temperature is controlled by the Leeds & Northrup system. The very small balls are hardened in the little furnace shown in Fig. 11. This furnace also rotates but it is heated from the outside, in other words, the rotating barrel is surrounded by the furnace. The balls are discharged through a pipe into the same cooling barrel which receives the balls from the larger furnace.

The second rough grinding of the larger balls does not differ in any respect from the first. The oil lapping process, however, which follows is of an entirely different nature and presents many points of interest. Fig. 12 shows the machine used for this purpose. In this machine also there are two spindles which, however, in this case are in line with each other. Each spindle carries a metal plate with a number of concentric grooves. The grooves are made V-shaped and the balls rest between them, as shown in Fig. 13, where each of the grooves envelopes the ball for about ⅓ of its diameter or perhaps somewhat less. Very shortly after a new plate has been put in service, the abrasive action of the ball changes the contour of the groove so that it will actually fit the ball. It will be noticed that there is a relief at the bottom of the V-groove which is made this way because it has been found that no satisfactory results can be obtained when the balls bear at the bottom of the groove. The grinding in this case is done by means of oil and an abrasive which constantly floods the plates. From a description of the grooves one can readily see that the ball can only travel in a circle and not in a radial direction as was the case with the rough grinding. In other words, it travels around one axis only, a motion which would cause the balls to assume an entirely different shape from what is desired. Right here we find how the proper method can overcome difficulties which could not be met by mere skill.

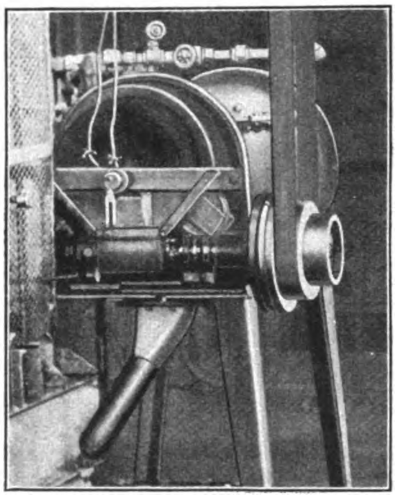


FIG. 11—SMALL ROTATING FURNACE FOR SMALL BALLS

Somewhere in the upper plate there is a large open-

ing in which fits a device which catches the balls and compels them to follow grooves made in that device. There are really two sets of grooves, one set coming from the outside of the plates, the other coming from the inside. The balls are compelled to follow the grooves which are so constructed that those which catch the outside balls deliver them back to the inside grooves and vice versa.

As the balls have been traveling around a certain axis while they were being ground it is almost absolutely sure that when they are delivered again to the plate they will not be in exactly the same position in which they were when they started, so that on their second trip they will be rotated around some other axis and every time they are returned to the plate a new axis of rotation is provided. The balls are in the machine about 40 minutes and the time required to make one complete revolution with the plate is only one or two seconds so that they are picked up and placed again on the plate several thousand times. As a result every part of every ball receives the same treatment.

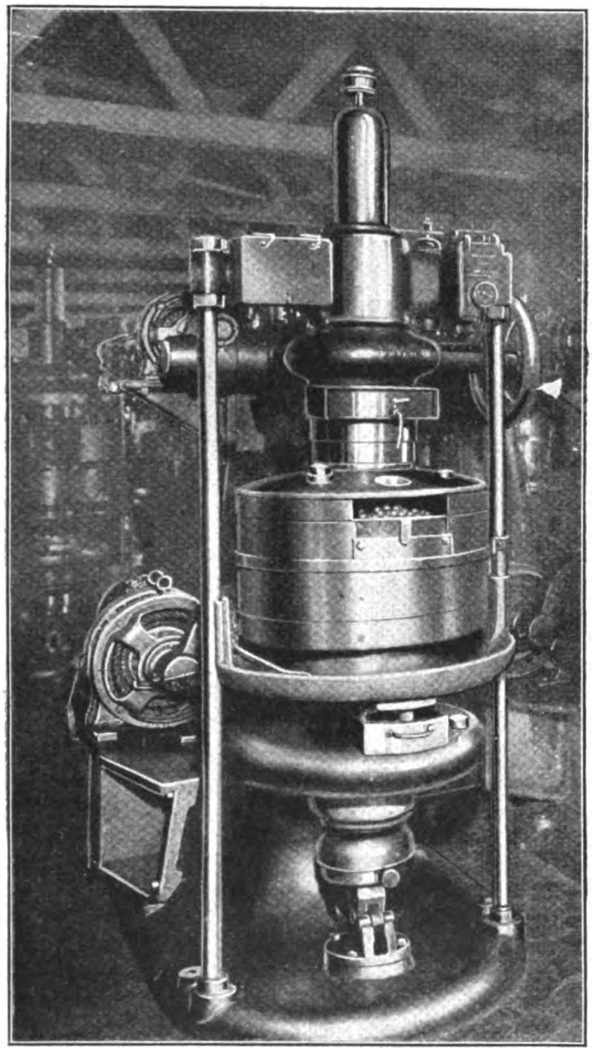


FIG. 12—OIL LAPPING MACHINE

It might be asked why the balls which come from the outside should be delivered to the inside and vice versa. A moment's thought will show that if this were not done the balls on the outside of the plate would receive a greater amount of grinding than those on the inside because they travel around a larger circle. The redistribution of the balls insures uniform grinding.

The principle embodied in this operation becomes clear when we consider that when there is a snow storm without wind, the snow will fall evenly over a large area notwithstanding that there is never a time when every square inch receives the same number of snow flakes. It is a fact that every operation does very little but the operations are repeated so many times without being controlled in any way that there is a 100 per cent chance that every point of every ball will receive the same treatment.

It was said that the balls after rough grinding presented the appearance of a great number of facets, each one with parallel scratches. As they come from the oil grinding machine the appearance is entirely different. Viewed under the magnifying glass they show an enormously large number of very fine pits or impressions, indicating that under the pressure of the plates the little grains of abrasive were pressed into the metal so that the balls had to roll over them with the result that a very small amount of metal was removed.

After oil grinding the balls are finish ground in a horizontal machine, shown in Fig. 14. In this machine there is a grinding wheel opposite the plate. The plate is grooved and soon after the wheel is set to work, it also will be grooved by the action of the balls. Here again the balls are caught, as in the oil lapping machine, but now they are not immediately returned to the plate but are brought to a contrivance which is called the magazine and which is located at the rear end of the machine.

The balls enter the magazine at its lower end, are elevated, mixed in a large chamber and then returned to the active part of the machine. This method also produces very fine impressions rather than scratches, but the impressions are so small that they can hardly be seen with a strong magnifying glass. The speed at which the grinding takes place is very low, being only about 300 ft. per minute, while the pressure under which they are held against the grinding wheel is very great, from 5,000 to 7,000 lb. in all. The balls remain in this machine from 8 to 10 hours. The time cannot be determined beforehand and is dependent on the rapidity with which the particular wheel acts on these particular balls. The operator has ample time to remove a ball every so often and test it on a minimeter and return it to the magazine.

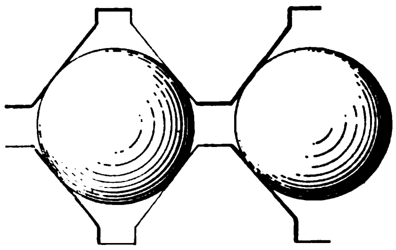


FIG. 13—DIAGRAM OF GROOVES IN PLATES OF OIL LAPPING MACHINE

When the balls are not more than $\frac{1}{10}$ of a thousandth over-size the machine is stopped and the balls removed. About 240 lb. of balls are charged in the machine at one time and it should be noted that this quantity of balls remains intact through the following operations. Not only must the balls be hard and strong but they must be of great uniformity not only of size but also of quality. Such uniformity cannot be obtained without having an almost absolute uniformity of material and methods of hardening, tempering, annealing, etc.

The Atlas Ball Company does not use the same specifications for all of its balls. The analysis of the steel varies with the size of the balls and, as a general rule, it may be said that the carbon contents go down and

the chrome percentage goes up with the increase of size of the balls. Chrome, by the way, is the constituent which permits of even hardening to a great depth. At the same time, no higher percentage of chrome should be permitted than what is absolutely necessary in order not to weaken the other desirable qualities of the ball.

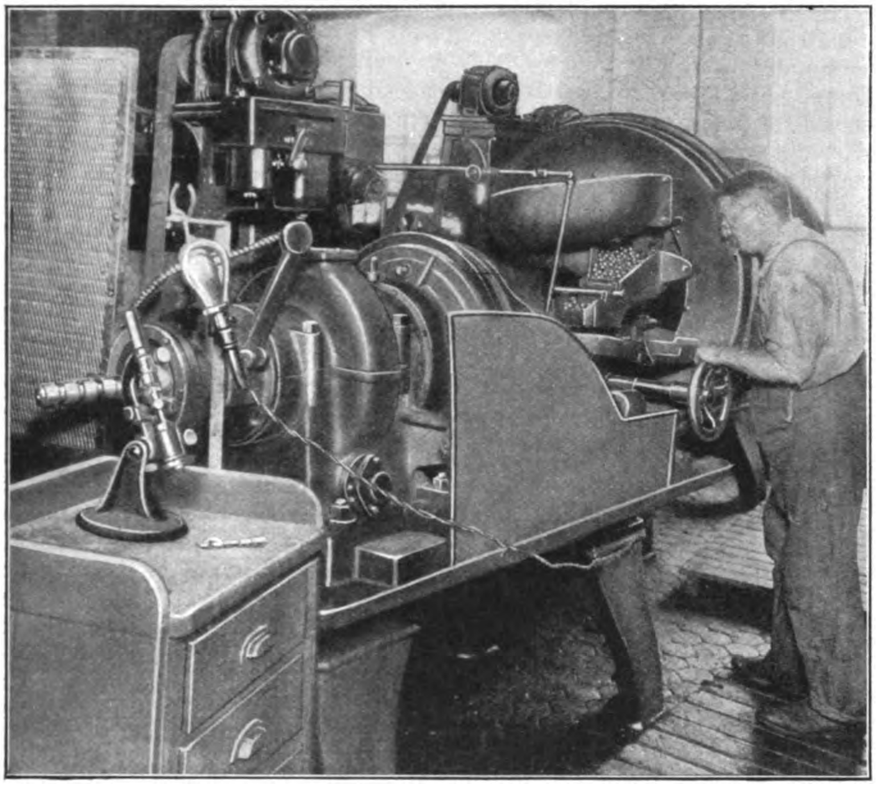


FIG. 14—HOFFMAN MACHINE IN WHICH BALLS ARE GROUND TO WITHIN 0.0002 IN. OF THEIR SIZE

The specifications of the steel range from 1.15 carbon and 0.00 chrome to 0.95 carbon and 1.75 chrome.

It is, of course, of importance to have the correct temperature for hardening but with the instruments obtainable at the present time this is no longer a problem. Of equal importance is the time during which the balls are in the furnace and it was pointed out how this time is regulated for the Atlas balls. For the tempering, low temperatures are used which will relieve the balls of unequal strains caused by the hardening but will not reduce their hardness.

In order to be sure that there shall be uniformity in the steel, the Atlas Ball Company makes it a practice to purchase all the steel of one heat, regardless of whether this amount is too much for their present requirements or not. Even then, the steel is carefully analyzed and followed up through the shop. In no case are two heats mixed in the manufacturing operations so that the mere date of the shipment of a set of balls permits the company to locate the steel from which these balls were made.

Among the shop problems peculiar to the making of Atlas balls and which are not found in most other shops, is the selection of the abrasives for grinding and polishing. Much harder steels are used and much finer grit than in ordinary practice. For instance, for rough grinding Aloxite wheels are used, 40 grit and 848 grade, or Alundum wheels of 60 grit and 848 or 846 grade, while for the Hoffman grinding, which, in a way, is a polishing operation, a flour of extreme fineness is used which is built up into a wheel of extraordinary hardness. It should be remembered that this wheel does not act like an abrasive wheel in ordinary cylindrical grinding machines, that is, the particles of abrasive do not cut as they pass the work and are finally broken out of the matrix, but the protruding fine particles of the abrasive roll over the ball and have a kind of generating action.

Another peculiarity which cannot be lost sight of in the making of balls is the fact that the size of the ball increases during the process of hardening and decreases during tempering. The change is great enough to be taken into consideration as it affects the amount of metal which must be removed by a slow process. A ½-in. ball increases in size practically 0.0015 in. by hardening and decreases again 0.0003 in. when it is tempered at a temperature of 300 deg. The roundness, smoothness and size of the ball can be appreciated by the eye and can be inspected and measured. Defects can be eliminated. There are, however, other qualities of the ball which do not show themselves, which cannot be detected without breaking the product, and yet are of at least as great importance as either of the other qualities.

In order to be of first quality a ball must be extremely hard and strong. Great hardness and strength do not, as a rule, go together. It is customary where these two qualities are required to make the outer surface hard and treat the steel in such a way that the inner metal is tough and will resist heavy strains without breaking. This method of combining strength and hardness cannot be followed with steel balls. A steel ball, in order to be useful for a ball bearing, must deflect or compress exceedingly little under heavy load. If the ball should compress to any appreciable extent its cross-section would become elliptical and it would offer relatively large surface to the ball race. As a result the ball would have

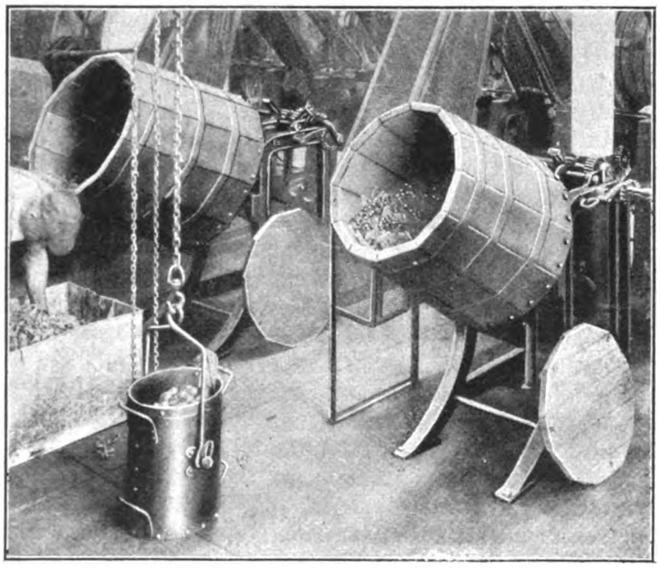


FIG. 15—TUMBLING BARREL USED FOR ROUGH AND FINISH POLISHING

to climb from its minor to its major axis when it revolves in the bearing and appreciable power would be consumed. The proper functioning of a ball bearing is based on the fact that a ball changes its shape very little and in order to be sure that such shall be the case the ball must be of extreme hardness throughout.

The next operation is the polishing which is done in two stages. All polishing is done in inclined barrels such as shown in Fig. 15. The first or rough polishing is done by means of Vienna lime. Four hundred and fifty pounds of balls are loaded in a barrel with the proper amount of lime and are slowly revolved for about 25 hours. This 450 lb. of balls is made up out of two or three sizes, the idea being that the smaller sizes will locate themselves between the larger ones thus causing more points of contact than if there were only one size of balls. The amount of 450 lb. should not be considered as the exact figure. It is made up of two batches of balls, each one coming from a Hoffman machine and, as the theoretical amount of balls given to such a machine is 240 lb., the total amount which is being polished at one time may be as high as 480 lb.

The rough polishing takes practically all of the 0.0002 in. which was left by the Hoffman machine. The final polishing is done by means of scraps of soft leather. The illustration shows this clearly. This last polishing operation removes practically no metal and is more in the nature of a burnishing than a polishing operation. Its duration is about 2 hours.

The subsequent operations of measuring and inspecting have already been described.

The Passing of Craftsmanship —Discussion

By S. N. Bacon

In the article under the above title which appeared on page 648 of *American Machinist*, Entropy expresses regret at the passing of craftsmanship. The writer does not agree that craftsmanship is passing but thinks it is merely shifting from actual skilled work performed upon the product to an even higher grade of work required in making tools of great accuracy that are capable of producing parts in large quantities. Forming and embossing dies for silverware and other ornamental work are good examples. It requires a high grade of craftsmanship to construct such dies properly, perhaps even more so than in the olden days. Then the parts which had been made by hand, although they were beautiful in ornamentation were not all of that same accurate detail which characterizes the present-day manufacturing methods and clever ideas in designing tools.

Another requirement of the present methods for interchangeable manufacture is the extreme accuracy of inspection gages. These gages are often the highest form of the craftman's art although they are not ornamental. It is regrettable that these wonderful tools are never exhibited, but the craftsman must surely derive considerable satisfaction in exhibiting the final product as for instance the metal pencils, mechanically engraved and such wonderful products as the radio, telephone, fire-arms and adding machines. The writer always has a wonderful sense of satisfaction when he sees a certain rifle or typewriter displayed for many of their principal parts are manufactured by the tools he has designed.

Standard Numbers for Steel

At a conference held in Washington, D. C., December 6, 1922, Lawford H. Fry reported a resume of European practice in the numbering of steel, based upon replies to a circular request for information sent by Dr. Agnew to the standardizing bodies of Great Britain, the Netherlands, Germany, France, Austria, Sweden, Belgium and Switzerland. Canada, Norway, Italy, Czecho-Slovakia and Japan made no reply.

Great Britain has done practically nothing since its adoption during the war, of the symbols of the Air Ministry. There is, however, a strong desire to adopt some other form of symbol for automobile steel. No system has been adopted in the Netherlands, although the Royal Institution of Engineers has standard specifications which were issued March 4, 1911. In these, the specified grades are designated by arbitrary letters. The Austrian Industrial and Trade Standards Committee has done nothing since the publication of a tabulated nomenclature of iron and steel on September 30, 1921.

Recent Action of Swiss Engine Builders

The Standards Committee of the Swiss Association of Engine Builders has just issued a series of tentative standard sheets covering carbon, nickel chrome and nickel steel. The principle of the system of symbols is to show the content of the carbon and of the principal alloys by using the standard chemical symbol of the element in question, and adding to it a figure showing the mean percentage of this element. Thus, a carbon steel with 0.25 to 0.35 per cent carbon is symbolized as C2n. The C indicates carbon and the amount is given by the figure 2, representing a mean content of 2/10 per cent. The "n" shows a maximum allowable content of 0.07 per cent phosphorus and 0.06 per cent sulphur. If the symbol is C2s, the maximum allowable phosphorus is 0.04 per cent, and the sulphur 0.03 per cent. If the symbol is written C2, then neither phosphorus nor sulphur is permitted to exceed 0.02 per cent.

The German Industrial Standards Committee has issued a tentative standard under date of August 12, 1922, covering steels without alloys, and untreated. This covers seven grades, for which the tensile strength and elongation in the annealed condition are certified. The grades are designated by arbitrary numbers, with the prefix St.

French Standardization Specifications

In France, the Permanent Commission for Standardization is issuing a series of standard French specifications for various materials. Five specifications are given, and the steels meeting these specifications are to be marked to indicate the material as follows: The number of the specification, a letter indicating the method of manufacture, and a number showing the minimum tensile strength specified. The French Commission points out that this system of marking gives a compact symbol which, by referring to a definite specification, leaves no room for misunderstanding. It also takes account of the principles laid down by the Consulting Committee of Manufacturers, which recommended that designations of material should be given in full and not in codes. As shown, the Swiss and the French systems are directly opposed to each other, and Mr. Fry seems to feel that the French plan is to be preferred in every way.

Single Hole Drilling on a Multiple-Spindle Machine

A Three Station Fixture—Work-Holding Jaws Closed by Weights—Carriers Adapted to Various Sizes of Work by Changing Jaws

BY W. F. SANDMANN

A FEW years ago the multiple drilling machine was brought into use only when large numbers of parts having ten to twenty or more holes in the same plane were to be drilled. It would have been considered absurd to even entertain the thought of using the multiple-spindle machine for parts having but a single hole to be drilled. Now the field of its usefulness has broadened until there is no such a thing as too few holes in a piece for it to be a multiple drilling proposition, so long as there is to be quantity production.

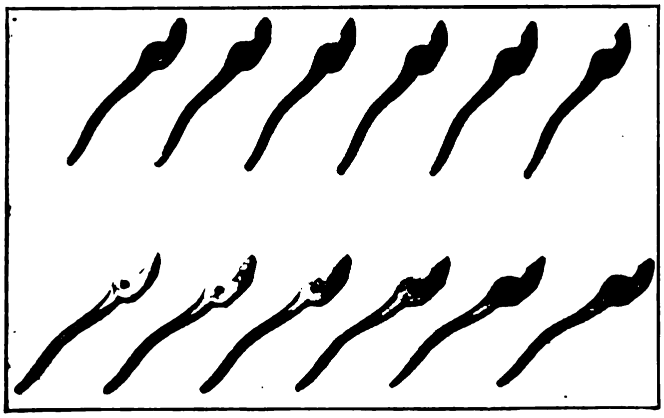


FIG. 1—THE WORK BEFORE AND AFTER DRILLING AND REAMING

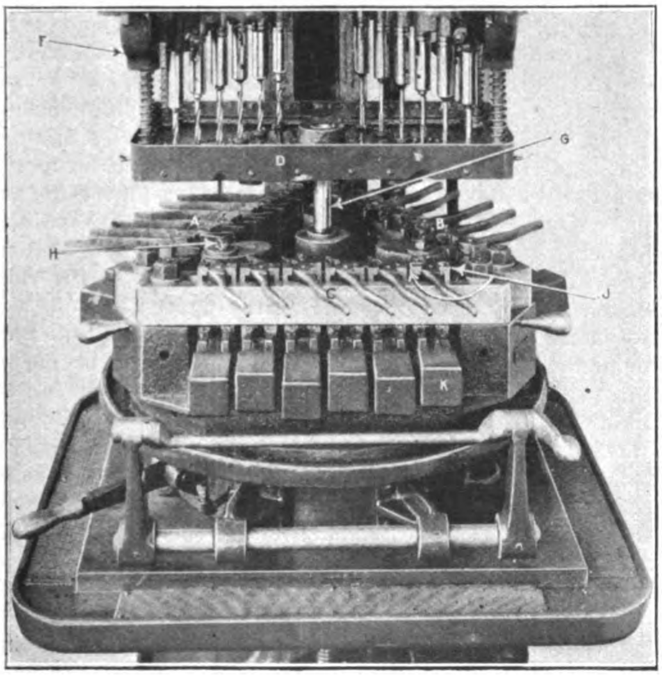


FIG. 2—THE DRILLING MACHINE WITH FIXTURE AND WORK IN PLACE

The success of single hole drilling on the multiple-spindle machine depends almost entirely upon the type of fixture that is used for securing the work while the operation is being performed. An example of an interchangeable fixture and machine set-up for single hole work is that used for the drilling and reaming of drop-forged plier halves. The plier halves are shown in Fig. 1, both before and after drilling and reaming the $\frac{3}{8}$-in. hole through the boss. A half dozen or more different sizes of these pliers are manufactured so the fixture had to be arranged to accommodate them all with the minimum of time for changing from one size to another.

A Natco Type 80, automatic cam-feed multiple-spindle drilling machine is shown in Fig. 2, with a three-station plier fixture in place on a rotating table approximately 2 ft. in diameter. At *A* six plier halves are shown in the drilling position, at *B* six more are in the reaming position after having been drilled at *A*, and out in front and from under the head of the machine at *C* are six plier halves drilled and reamed and ready to be removed from the fixture. The drills and reamers can be seen in their respective spindles and the construction of the machine allows each of these spindles to revolve at the proper speed for the tool it contains, making possible the simultaneous drilling and reaming operations.

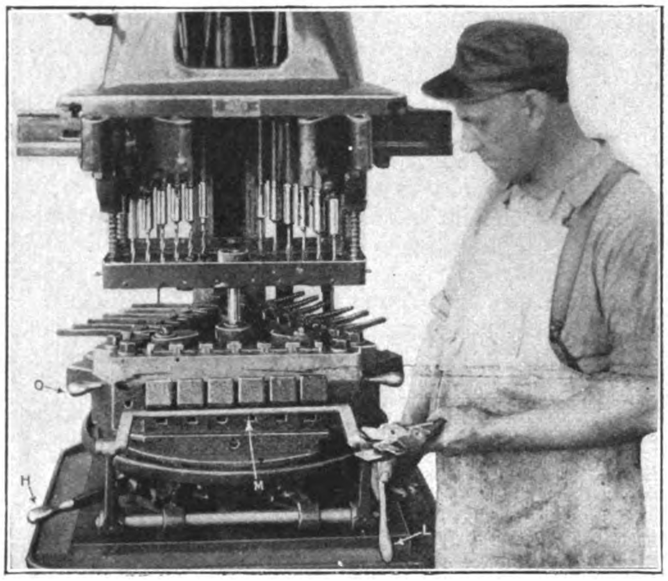


FIG. 3—REMOVING FINISHED WORK

The guide bushings for the drills and reamers are carried in the plate *D*, suspended from the head of the machine by four spring suspension arms *F*. The guide bushings are slip bushings within a liner bushing so that they can be easily changed to suit the size hole to be drilled or reamed. Around the edge of the suspension plate is a band of sheet metal forming a reservoir into which the cooling compound is pumped.

As the only outlet for the compound is through the bushings, the proper cooling of the tools is assured at all times.

When the head of the machine is fed down to begin the operation, the suspension plate *D* locates in the proper position on the fixture by means of the center-post *G* and whichever one of the three short dowels *H* that happens to be at the rear of the machine. The plate comes to rest on pads when it is ¼ in. above the work and the drills and reamers pass on into the work. The suspension springs are compressed tending to hold the plate tightly in position and the suspension rods pass into the opening in the head of the machine.

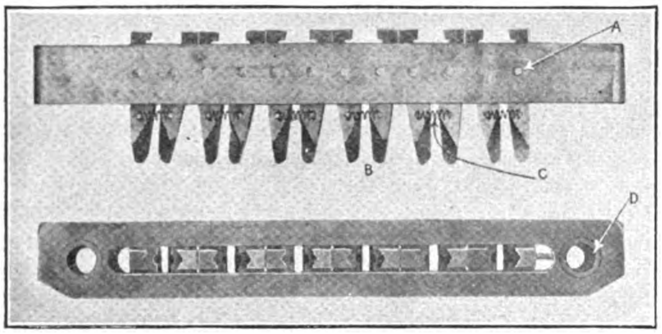


FIG. 4—ONE OF THE CARRIERS

Each plier half is held between a pair of equalizing V-jaws *J* which are spread apart at the bottom and forced together at the top on the plier by the action of the weight *K*. It is necessary that each pair of jaws be an independent clamping device on account of the variations in the diameters and thicknesses of the pliers, the forgings being in the rough at this operation with the exception of a ground side.

The operator is shown unloading a half dozen finished plier halves in Fig. 3. He presses down on handle *L* and the bar *M* is thrown up, lifting all six weights at the same time and allowing the jaws to spread open at the top. The six finished plier halves are removed from the fixture by a sweep of the hand and six unfinished halves placed in the jaws. The handle *L* is lifted, allowing the weights to fall back into place and the loading is completed. The unloading and reloading operations are performed while the machine is in operation, the only idle time being when an operation is completed and while the operator is pushing down lever *H* releasing the indexing bolt and swinging the fixture a third of a revolution by means of one of the handles *O*. This places the plier halves that have just been loaded at *C*, Fig. 2, in drilling position *A*, those that have been drilled at *A* in reaming position *B* and those that have been reamed in position *B* come around to *C* completely drilled and reamed. The operations of the cycle are then repeated.

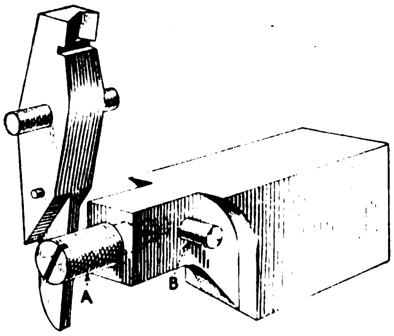


FIG. 5—DETAILS OF JAW CLOSING DEVICE

Two views of the carrier, or jaw holder, containing six pairs of clamping jaws are shown in Fig. 4. The fulcrum pins of the jaws are at *A* and the weight closes the jaws by spreading their lower ends at *B*. The spring *C* pulls the jaws together at the bottom when the weighted spreader is removed, causing them to open at the top and release the work.

The carriers are made sufficiently wide to support the plier halves before the jaws are tightened. The holes in the ends are bushed as at *D* and fit over studs in the fixture where they are held down by nuts. This construction permits a carrier to be removed and replaced by another, containing jaws for different work by merely taking off two nuts and washers. Several sets of carriers are provided.

Details of the jaw closing device are shown in Fig. 5. The screw *A* does the actual closing of the jaws and is removable so that different diameters of screws can be inserted for different spreads of jaws that may be required. It should be noted that the screw *A* comes into contact with only a thin edge of the jaw, as the sides are milled away toward the bottom. The weight fulcrums on the pin *B* and because of the positions of the fulcrum points in both weight and jaw, a pressure of not less than 70 lb. is exerted at the clamping point. The Vs in the jaws recede toward the bottom to cause a more pronounced holding down effect.

By the use of different carriers containing properly shaped jaws for the part to be held, and by inserting the correct size of pin for the spread required, the same fixture can be made widely interchangeable.

With the arrangement described a production of 720 drilled and reamed plier halves per hour is obtained with one operator against less than a total of 500 per hour by three operators using gang drills.

Effect of a Private Sidetrack on Insurance

An industry in the Middle West raises the question as to the possibility of obtaining insurance against liability for damage caused by a railroad while operating over a private sidetrack.

It appears that the industry, according to the terms of its contract with the railroad, has agreed to assume two distinct liabilities. In the first place, it has contracted to indemnify the railroad company against any legal liability arising in the event that property be damaged by fire caused by locomotives operating on the private sidetrack. This provision applies to the property of the industry or other property on its premises, except that belonging to or in charge of the railroad company. The industry thus agrees that it will not make claim or permit to be made against the railroad company in the event of damage to its property. In case fire insurance is carried, this agreement can be fulfilled by requesting the insurance company to endorse the policy to the effect that subrogation rights will not be exercised. An additional premium is usually charged for this endorsement. If there is other property on the premises which does not belong to the industry, the industry should be sure that it is covered by a fire insurance policy containing a waiver by the insurer of subrogation rights.

In the second place, the industry has agreed to indemnify the railroad company against liability for loss, damage or injury to persons or property while on or about said sidetracks, occasioned by any act or omission of the industry, its employees or agents. As it is customary for casualty companies to assume this contractual liability as a supplement to policies of workmen's compensation and public liability, insurance protection can thus be obtained.

Industrial Cost Accounting for Executives

Fifth Part — Business Functions and Their Organization—Classification of Departments and Designation by Mnemonic Symbols — Typical Organization Chart

By PAUL M. ATKINS

IN THE PREVIOUS articles we have surveyed very briefly the various elements of costs and the accounts and journals by means of which cost elements are recorded. It is now time to turn aside from what may seem to be the direct path of our discussion and spend a little time considering a subject, which, at first glance, may appear to have very little direct connection with our main topic. The subject, as was mentioned in the first article, is the functionalization and organization of a business. It is fundamental to the study of almost any problem concerning a business, and an understanding of it will be found not only helpful at various times in the consideration of our subject, but practically indispensable if the real significance of the method of expense classification which is described later is to be grasped.

Definition of "Functionalization" and "Organization"

Functionalization and organization may, perhaps, seem like long words with rather shadowy meaning. The first often seems to have an academic flavor and the latter is used to mean so many different things that it has lost much of its significance to most business men. They serve to describe certain ideas, however, better than any other words, and though these ideas are rather complex and have been made to seem much more difficult of comprehension than they really are, they are very useful to us in our discussion. Before going any further, therefore, let us see if we cannot agree upon definitions for these words which, while not entirely complete and exact will be sufficiently so to serve our purpose here and which can be improved, if necessary, later.

Functionalization, I think we can say, is the analyzing or breaking up of the business into its functions. Functions, in turn, may be defined as activities, and business functions as the various activities involved in the operation of a business. We speak, for example, of the functions of the purchasing department and mean by that all the various activities which are involved in the making of purchases and which are centered in the purchasing department. When we say the time-study function, we mean ordinarily the operations necessary to make a time-study. The functions of the foreman usually carry the idea of the various tasks which the foreman must perform in supervising the operation of his department. Often the expression is used to mean much larger units when marketing or selling functions are spoken of to indicate all the activities involved in selling the goods which have been produced. We see, then, that the word is employed to mean almost any activity which is involved in the operation of a business and this, in general, is the meaning which we shall attach to it in our discussions.

Organization is used to mean so many different things that no attempt will be made to enumerate them here for they are so varied and diverse that the reader would probably be more confused than helped thereby. The meaning which we wish to give to it here is that of the co-ordination and tying together of the various functions in such a way that they will work most effectively together.

Let us now turn our attention once more to the functionalization of a manufacturing business and study the problem a little more intensively. In the first place we can make one generalization which will hold, practically without an exception. A manufacturing concern can have its functions divided into three main groups. There are those activities which are concerned primarily with the production of the finished merchandise and which we can call the manufacturing functions. There are those which are involved principally in the selling or marketing of the completed goods, and which we can name the selling functions. And then there are those activities which are not directly connected with either manufacturing or selling but serve to aid them, or to co-ordinate or supervise them. Such functions as accounting, filing and general administration are examples of this class which we can probably best call the administration functions.

The particular grouping of functions we have given has considerable importance in cost accounting, as was pointed out in the third article, because it serves as a basis for the classification of expenses, a classification which facilitates both the control of the business and the allocation of overhead to the product. It is a grouping also that can be made for practically any industry no matter what kind of merchandise it produces.

Such a sub-division of a company's activities does not give a very satisfactory basis for their administration or operation. Except in the smallest businesses such units would be much too large and so we find that functions which can be carried on satisfactorily together are gathered together into departments. If departmentalization is done properly we will find that all the detailed functions which make up the three large groups are broken up into departments, and it is with these departments that we shall have to deal.

A Typical Small-Sized Company

Perhaps a simple example will help us to understand the problem which has been outlined. Let us take a moderate sized concern turning out a product made principally of steel and let us see what its functions are likely to be. In the first place there would be the functions involved in producing the finished goods, in this case, let us say, a foundry department, a machine shop and an assembling department. Then there are activities which exist almost solely to aid these operating departments such as the power department, the maintenance department, the planning department, the inspection department and the toolroom, and other departments, such as the engineering department and the purchasing department, the larger part,

For the author's forthcoming book.

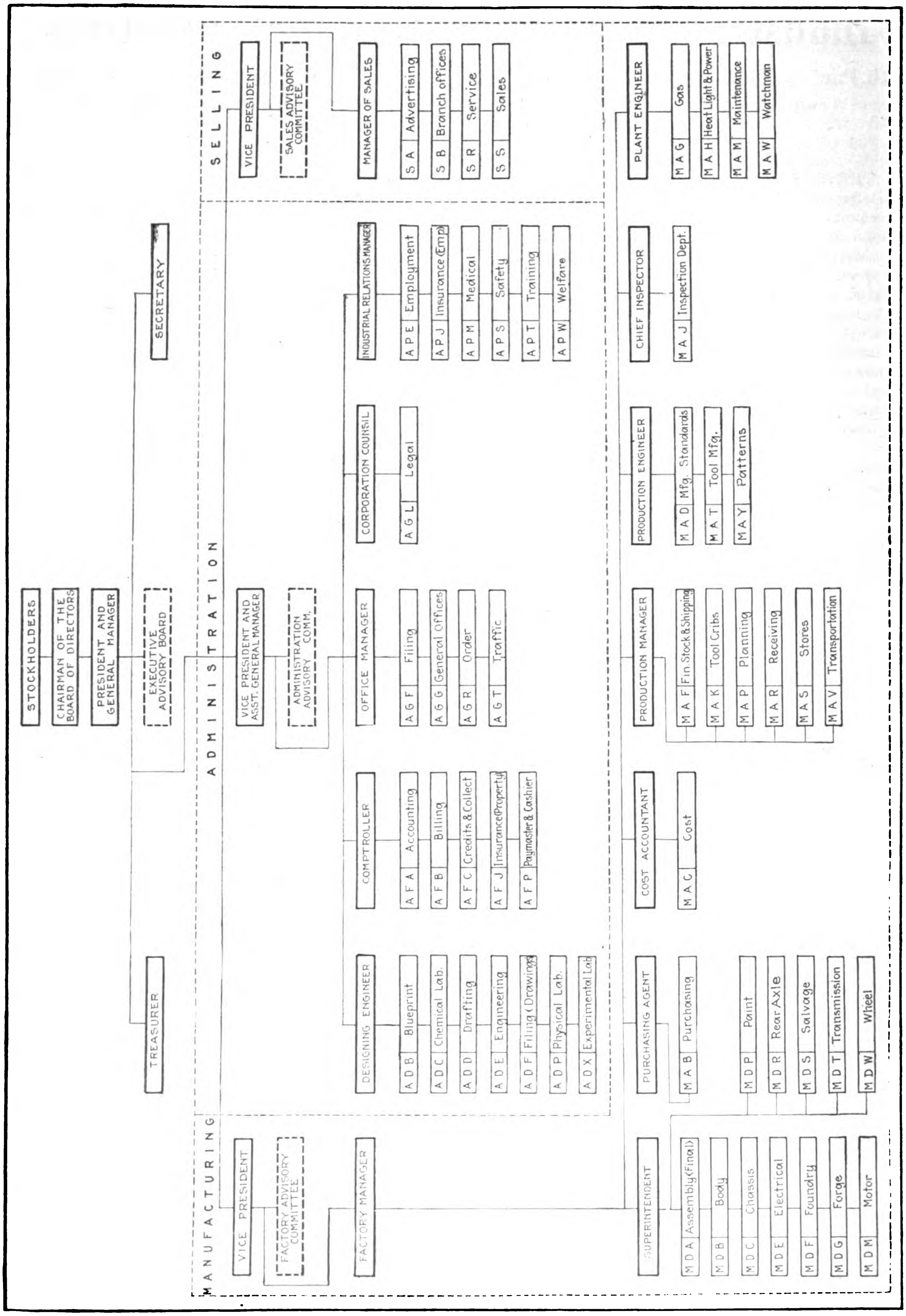


FIG. 3—ORGANIZATION CHART OF A LARGE COMPANY

though not the whole of whose services are to promote the work of the shops.

To handle the selling end of the business, departments like the advertising department and the sales department are necessary, and we can analyze the selling functions into these two groups. The general administration of the business will probably have the record-keeping functions placed by themselves in an accounting department and the writing and filing of letters and general office work can be gathered together into a general office department, while the policy deciding functions can be thus established in an executive department.

So far we have analyzed the functions of the business, but aside from the first division into the three main groups we have not classified them and experience has proved that a heterogenous collection of units is not very useful until it has been classified and symbolized, an act that is different from but closely related to classification. Both terms are subject to long definition, as in the case of functionalization and organization, but we can get along with definitions which are quite simple and at the same time sufficiently exact for our purposes. Classification is essentially the logical, systematic and orderly arrangement of related details, while symbolization is simply the giving of symbols to the details, symbols being nothing more nor less than short convenient names. It is quite possible, of course, to have a classification without having it symbolized and also to have items symbolized without having them classified. To be most satisfactory we must have both together. When we have further classified and symbolized the various departments we obtain something like the following:

THE AMERICAN METAL WORKING COMPANY

A. Administration functions
- AA Accounting department
- AE Executive department
- AB General offices department

M. Manufacturing functions
- MA Auxiliary manufacturing functions
  - MAB Buying or purchasing department
  - MAE Engineering department
  - MAH Heat, light and power department
  - MAJ Inspection department
  - MAM Maintenance department
  - MAN Personnel and employment department
  - MAS Stores, stock receiving and shipping department
  - MAT Tool manufacturing department
- MD Direct manufacturing functions
  - MDA Assembly department
  - MDF Foundry department
  - MDM Machine shop department

There are probably two features about the above table which will attract the reader's interest first. One of them is the classification of the manufacturing functions into two groups, the first called "auxiliary" indicating that they are an aid to manufacturing though they do not directly have a part in it, and the other "direct" indicating that the departments so classified are the ones in which the actual manufacturing operations are performed. Such a division is most useful when the problem of the distribution to the direct manufacturing departments of the expenses of the other departments is reached.

The second feature is the use of letters, and letters not in their consecutive alphabetical order, to designate the departments. Here we have an illustration of the use of the "mnemonic" system of symbolization, a system which endeavors to aid the memory by employing as far as possible the initial letters of the words which describe the item in hand and its place in the classification, the first letter indicating the principal sub-division, the second the group within that sub-division, etc. Let us take *MDM*, the machine shop department, as an example. The first *M* stands for the manufacturing group of functions, the *D* for the fact that it is the direct manufacturing group, and the second *M* shows that it is the machine shop department within that group. It may be clearly seen here that the position of the letter in the symbol, as well as the letter itself has a significance, a fact that is sometimes overlooked although everyone recognizes that 123 represents an entirely different number from 312.

There is another important advantage, among others, in the mnemonic system of symbolization in addition to the one which has been mentioned above and that is its expandibility. Only 22 letters are used because of the similarity of *Q* to *J* or *I*, of *O* to *Q* or zero, and of *U* to *V*, but even so we have 12 or 13 more than the number of digits available if figures are employed. Hence if only one unit is used in a symbol, 22 of them can be symbolized in a single class if the mnemonic system is used, and only 9 or 10 if numerals are utilized. If a symbol of two units is wanted we have a possible variety of combinations of letters of 484 as against 99 for the numbers, and the difference becomes increasingly marked as the number of units in a symbol is increased.

To offset the advantages there are some disadvantages. It is not so easy to use such symbols with modern tabulating machinery though it is not impossible to do so. Mr. C. M. Ford has described in a very interesting article entitled "Alphabetical and Mnemonic Symbols on Tabulating Machine Cards," in the May, 1921, issue of *Industrial Management* magazine how the problem can be solved. Also, it is not always possible to make the symbols mnemonic, as in the case of the inspection and personnel departments above where *J* and *U* are used instead of *I* and *P*. The *J* is employed because the *I* is never used, and *U* is utilized instead of *P* because the latter is already reserved for another department. In general, however, the advantages outweigh the disadvantages and slowly but surely we are seeing the mnemonic method of symbolization more frequently used.

The case which we have just presented is very simple and there is not likely to be any serious questioning in regard to the details shown therein. Let us, therefore, take up a more complex illustration now, one which is likely to raise a debate concerning some of the details. The following symbolized classification is intended to be typical only. It is the result of extensive study of the problem as it has been worked out for various concerns, especially those engaged in wood and metal working, and may be taken as a general model subject to modification in individual cases.

A TYPICAL SYMBOLIZED CLASSIFICATION OF FUNCTIONS

A. Administration functions
- AD Functions involved in designing and developing the product
  - ADB Blueprint and photographic department
  - ADC Chemical laboratory department
  - ADD Drafting department
  - ADE Engineering department
  - ADF Filing (blueprint and drawings) department
  - ADP Physical laboratory department
  - ADX Experimental department

- AF Financial functions
  - AFA Accounting department
  - AFB Billing department
  - AFC Credits and collection department
  - AFJ Insurance (property) department
  - AFP Paymaster and cashier department
- AG General administration functions
  - AGE Executive department
  - AGF Filing (general) department
  - AGB General office department
  - AGL Legal department
  - AGR Order department
  - AGT Traffic department
- AP Personnel functions
  - APE Employment department
  - APJ Insurance (employee) department
  - APM Medical department
  - APS Safety department
  - APT Training department
  - APW Welfare department

M. Manufacturing functions
- MA Auxiliary manufacturing functions
  - MAB Buying or purchasing department
  - MAC Cost department
  - MAD Manufacturing standards department
  - MAF Finished stock and shipping department
  - MAH Heat, light and power department
  - MAJ Inspection department
  - MAK Tool cribs department
  - MAM Maintenance department
  - MAP Planning department
  - MAR Receiving department
  - MAS Stores department
  - MAT Tool manufacturing department
  - MAV Internal transportation department
  - MAW Watchman department
  - MAY Pattern Department
- MD Direct manufacturing departments

These departments are sub-divided usually either according to the kind of product turned out as, for example, engine department, rear axle department and body department of an automobile factory, or according to the kind of work to be performed, such as the lathe department, punch press department and heat-treatment department in a general metal working factory doing work largely or entirely to order.

S. Selling functions
- SA Advertising department
- SB Branch offices department
- SS Sales department

An examination of the above classification will show that there are a number of divergencies in it from what is normally found for manufacturing companies. One of the reasons why these differences have been made so apparent is to call them to the attention of the reader and to get him to think about the causes of them. It not infrequently happens that we become so accustomed to doing a thing in a certain manner or to thinking about it in a particular way that we do not realize that there may be better ideas concerning it, or that some of its phases have been overlooked.

As we look at the classification just given, the first section of it—especially if our interests be in the factory—probably seems misplaced. Such functions as those ordinarily carried on by the engineering department, drafting department and experimental department, are very frequently operated under the direction of the factory manager as activities which are directly, and practically entirely, connected with the fabrication of the finished product. When they are concerned only with preparing information for the benefit of the shops the classification of such departments, as was indicated in the first classification, is very appropriately under the head of the auxiliary manufacturing functions. It must not be overlooked, however, that sometimes the design and development of the product is affected by and, in turn, influences the marketing policies of the company. Our large electric equipment companies furnish one good illustration. The design of automobile bodies also is quite as much a matter of pleasing the public taste as it is of supplying the factory with information as to how they should be built.

While, therefore, on many occasions the engineering and allied activities are properly grouped under the head of manufacturing functions, there are often times when they serve both marketing and manufacturing and aid in developing general business policies so that they are correctly classed as administrative functions. Of course, such a splitting up of activities, as is shown here, into an engineering department, drafting department, blueprint and photographic (or photostat) department and filing department is only necessary or desirable in the case of large concerns.

Hardly anyone will question the propriety of treating the financial functions as a sub-division of the administration functions. The real head of this group of departments is naturally the treasurer but he is not properly located in any of them but in the executive department (discussed later) with the other executive officers. The departmentalization of these functions is such as is likely to be found in a moderately large concern and the titles are so self-explanatory that no additional explanation is needed except, possibly in one case. The property insurance department is not frequently found, but for large concerns whose inventories are constantly and often rapidly changing, such a department, or, at least, the recognition and organization of the insurance function is necessary if the company's property is to be fully protected at the least expense.

General Administration Functions

The general administration functions can have only brief consideration here though they form a very interesting subject of study. They include in the first place the policy forming activities as represented by the executive officers, principal managers and their personal assistants grouped together into an executive department. In addition, there are other departments whose location in this group is due more, perhaps, to the fact that they do not properly belong to any other group than to any common tie among them. The filing department is to care for all material which is to be filed and which is not better located elsewhere. It may often be conveniently joined with the general offices department whose activities include the stenographic work, telephone and messenger service, internal mail service and care of incoming and outgoing mail. The order department takes the orders received from customers and prepares the necessary papers so that the goods may be shipped at once or that the factory may begin its work upon them. It serves as an operating link between the sales and the shipping or planning departments. The traffic department has the task of controlling the movement of goods, both incoming and outgoing, while they are in the hands of a common carrier, and thus serves both the selling and manufacturing sides of the business.

When we come to the personnel functions gathered together under the general head of administration, we take up another topic which is likely to raise some questions in the mind of the reader. Probably most manufacturing concerns which have organized the activities involved in their relations with their em-

ployees, other than those of supervision, have placed them in the group of manufacturing functions. As in the case of the functions involved in the designing and developing of the product, this is undoubtedly correct under many circumstances, as for example, when the factory is located away from the general offices of the company and hence not in immediate contact with the general administration of the concern. Under such conditions it would be quite appropriate to organize employee relations departments as a separate group co-ordinate with the auxiliary functions, or even, in the case of a small concern, as a single department in the auxiliary group.

Personnel and Purchasing Departments

There are other occasions, however, when such an arrangement is not so sound. If we find, for instance, that many of the employees are in the administration and selling departments so that a considerable part of the service rendered by the personnel departments is to those groups, then the logic of the situation points to the inclusion of the personnel departments in the administration section. We have additional reason for reaching such a conclusion in case a large part of the work of these departments consists of what may be loosely termed "welfare work" whose results are expected to benefit the business as a whole rather than simply the manufacturing departments. What is sought here, however, is to call the possibilities to the reader's attention and not to force upon him any particular conclusions.

When we turn to the departments which have been placed in the auxiliary manufacturing group we find that most of them logically and practically belong there without any serious question. One or two may need some brief explanation, however, and the dividing line between several of them needs classifying for some readers, perhaps.

The desirability of so placing the first department of all on the list may, quite possibly, be questioned by some. Since the purchasing or buying department directs the expenditure of such large amounts of the company's funds, it would seem proper to include it as a financial department. More often, however, the prime function of the buying department is to buy material to meet the needs of the factory. The fact that it causes the disbursement of money and purchases materials and services for other than factory departments is of secondary importance, though often a factor not to be overlooked or left out of consideration. Hence, in most cases, the classification given is best for this department.

The second department in the auxiliary manufacturing group, the cost department, may also appear misplaced, and since it is the department of most interest to us here and as the pros and cons concerning it are pretty well balanced, it may be well to consider it rather carefully. At first glance it might seem as though the logical place for it would be in the same group as the accounting department, provided it did not form a part of that department. This feeling would be still further reinforced when one considers that the work of the department is largely for the benefit of the business as a whole. On the other hand, there are important reasons why the cost department should be classed where it is. A large part of the results of its work is, or should be, for the benefit of the factory and for the control of its operation.

The most important reason, however, is a purely practical one. While the connection between the cost department and the accounting department must necessarily be very close if both are to operate successfully, the number of entries which pass from one to the other is usually comparatively small, especially in relation to the number of entries which the cost department receives from the planning department. In most cases it will be found that about ninety per cent of the material which must be handled by the cost department comes from the production control records. In many instances also, these papers and vouchers, must be utilized with a minimum of delay if the work is to be successfully carried on and mistakes rectified before it is too late to do so.

Most of the other departments mentioned here need little discussion. Their general scope is evident from their titles. The manufacturing standards department is probably the least well-known of all of them and a word of explanation may be in order here. It is the department whose prime function is the establishment of the operation standards—the making of time studies, the routing of work through the factory, the preparation of standard practice instructions and instruction cards, the setting of tolerances on materials and specifications for the product at various stages of its fabrication, etc. In the past, its functions have often been treated as a part of the work of the planning department and the relationship is, of course, very close. It is often better, however, to segregate them as has been done here.

When all the various functions of a business have been analyzed and classified, the next step is to prepare an organization manual in which a concise but accurate description of what each department is to do should be given. There is no space here to discuss it, but in the following article its preparation and use will be explained and an illustrative section describing the functions of a typical cost department will be given.

Organizing a Business

There is one other matter, however, which does deserve consideration now. The process of analyzing a business into its various functions and departments is essentially a "breaking up" process. It is quite essential, but there is a final step which is equally important and that is to combine and co-ordinate the departments into what we call an organization in such a way that the business may operate with the least amount of friction and with the greatest efficiency.

In approaching the study of the organization of a business the first point which needs emphasis is the fundamental necessity of organizing on the basis of functions or departments and not on a basis of individuals. Departments should be co-ordinated because their activities have points of contacts and not because their respective heads have mutual sympathies. If the criticism in many books in regard to certain types of organization are read with this thought in mind, it will be found that many of the troubles complained of are due to the attempt to organize a business on the basis of personalities and their characteristics instead of on the basis of functions.

There are various so-called "types of organization" such as line, line and staff, Taylor and committee; and much has been written about the advantages of each. In actual practice it will usually be found best to combine several of them in co-ordinating the various

departments and in analyzing and organizing the work within the departments. In some situations one form will prove superior to the others, but in all cases the utilization of the various activities as the units of organization should be adhered to without exception. In a later article where a bibliography of cost accounting will be presented, references will be given to works where the different types are described.

Just as the analysis of the business into departments is recorded in a permanent form in an organization manual—a record which provides the material for the construction of an organization—so the organization itself should be given permanence by being recorded in the form of an organization chart an illustration of which is given in Fig. 3. It will be noted that various types of organization find places in different parts of the chart and that the principal groups of departments are set off by themselves. The only relationships between functions and departments are those of authority and responsibility, reciprocal relationships in other words. Many a good chart has been spoiled by having too much recorded on it. The basic chart should be supplemented by others on which the lines of coordination may be shown.

The most satisfactory way is to select a single department and group around it the other departments with which it has contacts and then plot the relationships, using different kinds of lines to show the different ones. It will be found that if this is done for a few principal departments and functions no need will be felt for the same kind of thing for the others for all except a few insignificant relationships will be covered.

System for Locating Reference Prints

By Charles B. Johnson

A source of constant irritation and avoidable delay exists in many drawing offices on account of the inability of designers to secure the necessary blueprints or drawings for reference at the time that they are required. Nothing can be more annoying, nor can more easily take a designer's mind from the design upon which he is working, than the necessity of a protracted search for some print that he wishes to refer to at that time.

The more difficult to find, the more desirable the print seems, and the man determines to have this particular print no matter how much time and energy is expended searching for it. In case he is unable to locate it, his mind is constantly reverting to it and he is continually trying to find it. If it proves absolutely necessary, and the work is indefinitely held up, he, in all probability, calls his superior's attention to the matter, whereupon orders are issued to someone, usually the office boy, to "find that print."

This condition exists in many plants through neglecting to provide a satisfactory system of checking out prints or drawings. In fact, in some organizations it is considered superfluous to have a checking system of any kind. It is needless to say that this is a very undesirable state of affairs, and in such offices efficient work is impossible. The designers and draftsmen are allowed free access to all files, from which they remove drawings or prints as they may require them and then return them at their leisure. This means that they are dumped miscellaneously or carelessly on the top of the filing case, to be refiled later by someone who has a few minutes' spare time and who often is ignorant of the necessity of refiling them correctly. As a result, a great many drawings are misfiled. For all practical purposes, they are lost until someone discovers them while searching for either the particular one or some other.

A system which to a great extent makes it impossible for this condition to exist, is to place someone in direct supervision of the files. Upon a print or drawing being issued, a card is filled out with such information as the name of the person, date and drawing number, and it is filed either alphabetically or numerically. The numerical system has the most to recommend it on account of its ease of installation and the simplicity of maintenance. The party to whom the print or drawing was issued is held responsible for any damage or loss which may occur while it is in his possession.

New Cards Frequently Issued

Periodically, say at least once each week, the person holding the drawing or print should be required to reissue a duplicate card bearing the new date. This system will eliminate the confusion arising from the practice among designers of loaning reference drawings to each other. The one to whom they are loaned neglects returning them or perhaps re-loans them. The result is that where no card is re-issued the files are apt to carry charges against men for several weeks, or possibly months, who have re-loaned the prints.

This condition necessitates an extended search being made, and the party requiring the print usually insists that the searching be done by the party to whom it was originally charged. In either case the resultant loss of time is expensive to the concern, and the designer to whom the print is charged is annoyed by the fact that he must take what he considers valuable time to locate the print—perhaps in the beginning he was forced to find it for himself, and he feels that the one who now requires it should do the same.

If the re-issuance of cards is insisted upon, the files are automatically kept up to date within the time limit set by the issuance of the cards, and thus is eliminated the waste of time which might be more profitably employed. The cards are comparatively inexpensive and may be of any suitable size and design, although it is not recommended that they be so large as to require a bulky filing case. One 2x3 in. should be large enough for all purposes.

Making Expensive Taps in a Railroad Tool Room

By Arthur C. North

The first article on "What's Wrong with the Railroad Shops," reminded me of an experience I had when I was in charge of the small tool room in a railroad shop. This tool room was equipped with a 14-in. x 8-ft. lathe, a 16-in. shaper, a universal milling machine, a small drilling machine and an emery stand.

When I first took charge the general foreman's orders were to make all tools. Not long afterward we needed some regular $\frac{1}{4}$-in. hand taps. I told the foreman that it would be much cheaper to buy them but the only answer I got from him was a gruff "Make everything."

I did, and they cost nearly fifty cents apiece. They could have been bought for fifteen cents each from any local dealer and would have been available sooner.

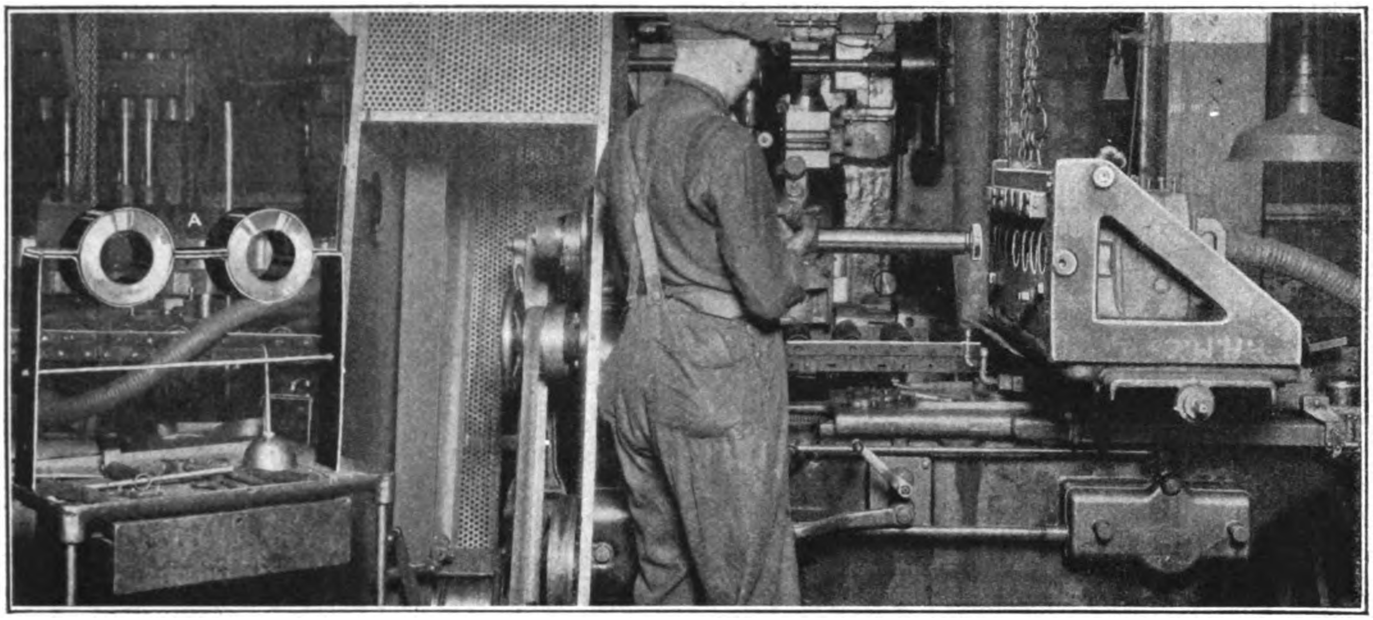


FIG. 1—GRINDING THE PIERCE-ARROW CYLINDERS

Grinding Data from the Pierce-Arrow Shop

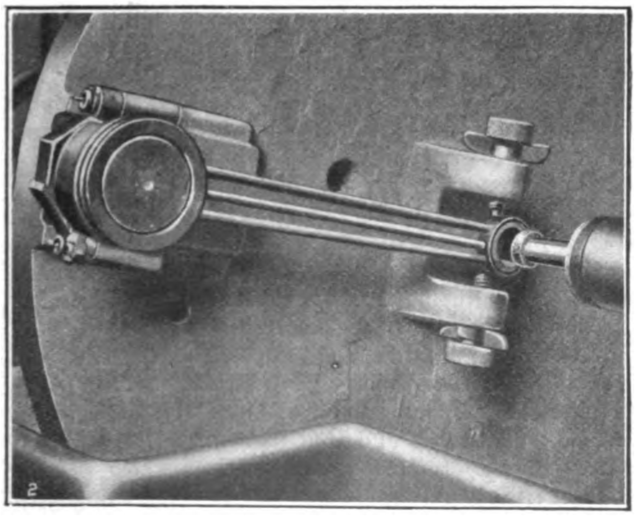
Testing Cylinder Gages—Grinding Bronze Connecting-Rod Bushings—Forming Steering Balls—Grinding Aluminum Transmission Covers

BY FRED H. COLVIN
Editor, *American Machinist*

THE INCREASED use of grinding as a machining method in automobile manufacture is evident in almost every shop one visits. There is also quite a diversity as to the grinding practice, involving wheel speeds, grades of wheels, and similar points. While a wheel surface speed of 6,000 ft. per minute is still considered advisable, there seems to be a tendency in many quarters to reduce this speed to some extent. As one grinding man expressed it, "We talk about 6,000 ft. as a suitable grinding wheel speed. Considering belt slippage and speed variations, however, we are very well satisfied if we get 5,200 ft. in actual practice." In the examples which follow, it will be noted that the wheel speeds vary to some extent, according to the work in hand, as is almost universally the case.

Grinding a Pierce-Arrow cylinder block on a No. 60 Heald machine is shown in Fig. 1. The wheel is 3½ in. in diameter by ¾ in. face, and has a 1¼-in. hole. It is a No. 30 grain and the grade is known as the H-LoTens, by the makers, the Precision Grinding Co. The same wheel is used for both roughing and finishing, the spindle speed being 6,600 r.p.m. The cylinders are bored to allow from 0.015 to 0.018 in. in diameter for grinding. The rough grinding leaves 0.003 in. for finish. The average production is 15 min. for each bore, or 90 min. for the six-cylinder block. This time is from floor to floor, including all handling.

A noticeable feature is the heavy ring gages mounted at *A*, by which the operator tests his inside gages. The ring gages represent the high and low limits. The



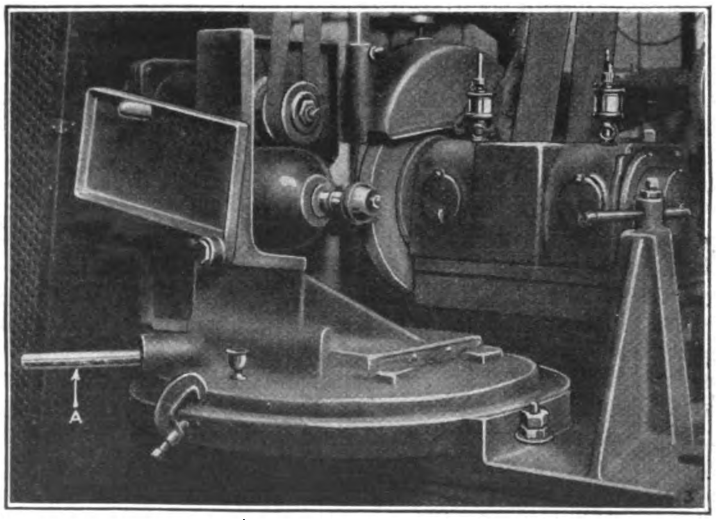


FIG. 2—FIXTURE FOR GRINDING CONNECTING ROD BUSHINGS. FIG. 3—GRINDING STEERING KNUCKLE BALLS

tolerance is 0.0003 in. for both diameter and out of roundness. When the cylinders are inspected, the size of each bore is stamped on the outside of the block as an aid in selecting pistons which shall be just right in every way. This does not mean that the whole dimension is stamped on each cylinder. If the bore is found to be just the nominal size of the cylinder, the block is stamped 0. If it is above or below the nominal size, the exact variation (within the tolerance, of course,) is stamped on the block, with a plus or minus sign before it.

Grinding Bronze Bushings

Another grinding operation is shown in Fig. 2, where the bushing in the small end of the connecting rod is being ground on a Bryant internal grinding machine. The illustration shows very clearly the method of holding the connecting rod. By locating the large end firmly on the pin as shown, and holding the small end lightly between the knurled screws, the hole can be ground not only to the correct center distance from, but also parallel with, the large bearing. Wing lock nuts make it easy to clamp and to release the screws.

The bronze bushing is $1\frac{3}{4}$ in. long and has a hole $1\frac{1}{8}$ in. in diameter. The wheel, an alundum, known as 3,860 K, is 1 in. in diameter with a $\frac{3}{8}$-in. face, and has a $\frac{7}{16}$-in. spindle hole. The production is 15 rods per hour.

Owing to the desire to have a polished surface in the hole, the final finishing is done with a reamer, 0.002 in. being left for this purpose.

Form Grinding a Ball

The method of grinding one of the balls which form part of the steering mechanism is shown in Fig. 3. This work is done with a formed wheel on a Landis machine. The wheel, an American corundum 54-N, is 12 in. in diameter with 1-in. face. In addition to the face of the wheel being concaved, the work table carrying the ball is swung on its central pivot by the handle *A*. The wheel is dressed by a diamond mounted on the work table, so as to be readily swung past the face of the wheel at the correct radius. The wheel speed is 1,800 r.p.m., and the work speed 400 r.p.m. The stock removed is 0.020 in., and the production is 22 balls per hour.

Still another job, though not illustrated, is grinding the joint face of the aluminum cover for the transmission case. This is done on a Pratt & Whitney vertical-spindle surface grinding machine with a Norton elastic wheel known as No. 46-4. The wheel is of the ring type, 14 in. outside and $10\frac{3}{8}$ in. inside diameter and 4 in. deep. The production is 25 covers per hour.

Unshackle Business

By J. Bainter

It has been said that ours is the most governed and the worst governed nation on earth with the exception of Russia, and possibly of Mexico. The words were spoken with reference to the legislation that hampers our business activities.

The people of our country seem to believe that all big and little defects in our political, social and industrial organizations can be remedied by legislation. The result has been a multitude of laws that are often conflicting and that leave the business man shackled. The type of regulation that he has been subject to is apt to kill his initiative and prevent the proper development of our national resources. As a shining example, the purpose for which the Sherman Anti-Trust Law was made has been perverted. This law was never intended to interfere with private business, although it is now construed in that way.

The details that come up daily in business are so regulated that the business man does not feel free to manage his enterprise in the way in which he would naturally do it. It is not possible for him to be running to a lawyer with details that come up possibly every hour, and yet that is what is required in order to carry on in strict conformity with the law those activities that are necessary in industry and business.

Certainly a law such as the Sherman Law to prevent those things morally wrong in business, particularly with reference to monopolies, is very desirable. But, public opinion was so aroused by the action of the so-called trusts some years ago that it has not yet had the opportunity of cooling off and examining just what sort of co-operation between businesses is beneficial and what is detrimental. There is beginning to crystallize among business men, however, a sentiment that it is hoped will ultimately have an effect on our laws.

The men who control and operate an industry should be more free to care for their interests in the manner that is best for those interests, provided that nothing is done to injure the public. Slowing up the functions of our business eventually must result to the harm of the country. What can be done about it is not now certain, although the first step seems to be to stop promiscuous legislation regarding business and then to relieve business of some shackles now on it.

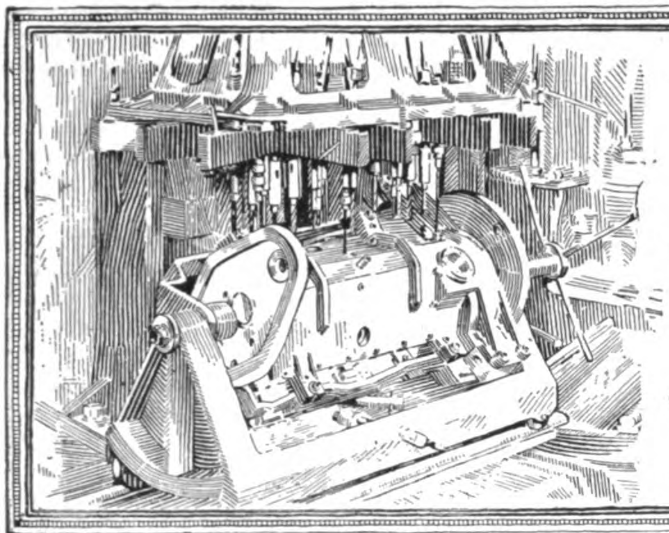
Men Who Make Better Executives

By Frank V. Faulhaber

In selecting employees for promotion in the large machine shop, the man invested with this responsibility may be unduly influenced in his choice by the fact that those he finally picks have shown brilliance in a certain line of work. But, is it wisest to have particular preference for this type of employee? Pay heed to what the superintendent of one large plant has to say on this subject.

"In my many years of experience I have learned that it is not always the best course to place responsibility on the shoulders of what I call the 'special-job men.' The employees I have in mind usually show talent for one line of work and do this very well. I have found that this kind of man does not make the best executive. He is not the man to be chosen because the individual who knows something of the various operations can rightly give better instructions. This being particularly true in the case of the minor operations.

"All due credit to the man who performs one task unusually well. But he is not the man to place in charge of others. It has been found, too, that it is best to keep the man who can do one task well right at his work, for that is his natural bent. His efficiency is otherwise lowered under responsibility. 'Brilliant' men have a tendency to be erratic and that alone is a good reason for selecting for promotion such men as know a little bit of everything and can learn as they go along. In my experience, they have been much more dependable."



Tool Engineering

By
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President and Chief Engineer
Dowd Engineering Company, New York City

Design of Piercing Dies Concluded—Dies for Formed Work—Multiple Piercing and Perforating Operations—Examples of Dies for Key and Radiator Fin

When work which is to be pierced has been previously drawn or formed, the dies must be constructed so that the work can be located properly and supported so that it will not spring during the operation of piercing. Naturally a great deal depends upon the shape of the work which is to be pierced, but in cases of this kind a nest or seat can be provided in the die into which the work can be fitted. Fig. 486 shows two dies for piercing a piece of formed work. The work *A* shown in the upper example has been formed in a previous operation, and there are eight holes to be pierced in the flange. The construction of the die for this operation is very simple. The shoe *B* has mounted upon it the die *C*, in which the work locates by the outside formed surface in such a way that the flange which is to be pierced lies on the surface of the die.

The punch holder *D* carries eight punches *E*, and these are located and guided in the stripper *F* as shown. The stripper is perfectly held in place by the punches, and its movement is limited by the screw *G*. The required pressure to hold the stripper down is provided through the springs *H*. This example illustrates clearly the action of the stripper plate and punches in connection with a piercing operation of rather simple form. If desired, additional refinement can be obtained by using bushings in the stripper plate.

Another example in the lower part of the illustration shows a die for piercing a hole in the end of the same piece of work. Here the piece is turned over and located on two studs *K* and *L*, which are mounted on a stripper plate *M*. This stripper is so made that it is a sliding fit on the punch *N*, which guides it in its movement up and down. The upper end of the punch locates the work so that as the punch holder *O*, which has the die *P* mounted on it, passes downward, the die *P* strikes against the end of the work and forces the latter down over the punch, thus producing the hole. The pressure pins shown at *R* and *S* are simply used to apply the necessary pressure to support the locating plate. Both of the dies shown in this illustration are used for high production work when progressive operations are performed, yet it may be seen that both operations can be performed simultaneously by making a combination die in which both principles are used at the same time.

When a number of holes are to be pierced in a blank and when these holes are very close together, the method of holding the punches is somewhat different from those which have been previously illustrated. In the example shown at *A* in Fig. 487 there are six oblong slots *B* to

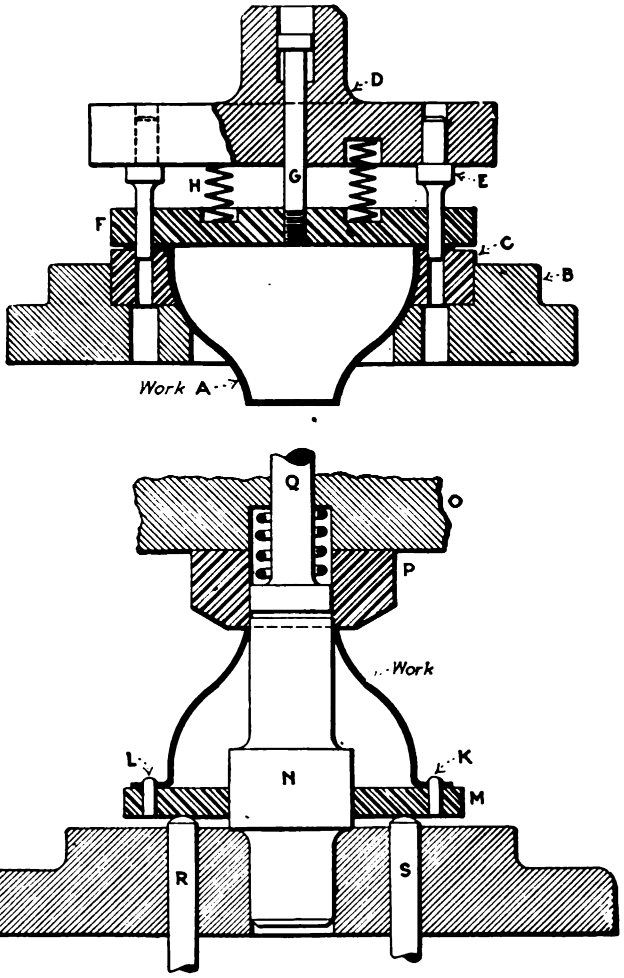


FIG. 486—DIES FOR PIERCING FORMED WORK

be pierced in the strip indicated. One method of holding punches for an operation of this sort is shown at *C*. The piercing punch *D* is held between the plates *E* and *F*, these plates being fitted into a slot *G* in the punch holder *H* and held in place by the pressure of the set-screw at *K*. The construction of the plates *E* and *F* is

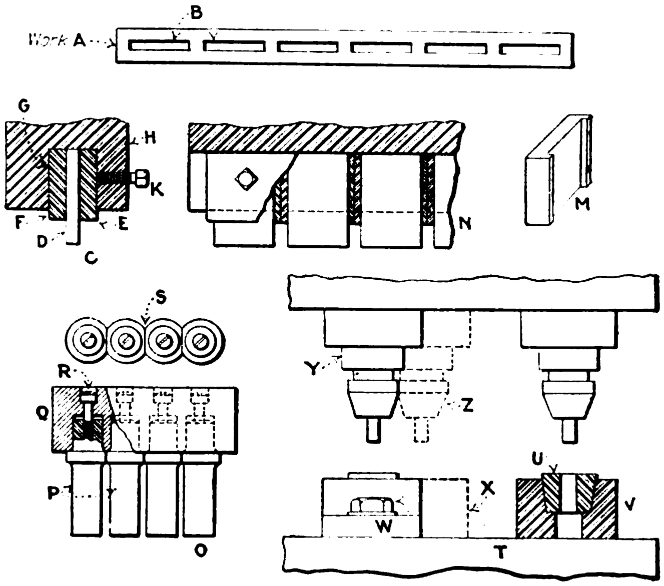


FIG. 487—METHODS OF HOLDING GANG PUNCHES AND ADJUSTABLE PUNCHES AND DIES

clearly shown at *M*, while at *N* is shown the method of setting several of these units in the punch holder.

Round holes which are to be pierced close together may have the punches held in various ways, among which are those shown at *O*. The punches *P* shown here fit into a punch holder *Q* in which they are kept in position by means of the fillister-head screws *R*. The flanges are cut away as shown at *S* to permit the punches to be placed closer together.

Work is occasionally encountered in which the spacing of the holes varies somewhat, yet the piece itself is uniform in size. For cases of this kind it is often satisfactory to design an adjustable punch and die like that shown at *T*. The die *U* is held in a holder *V* which is fastened to the die shoe by means of screws *W*. This unit is so arranged that it can be moved in either direction, as shown by the dotted lines at *X*. The same method of adjustment is applied to the punch and punch holder *Y*, so that it can be set in one direction or the other as indicated at *Z* by the dotted lines.

Perforating Cylindrical Work

Several examples to illustrate the methods of punching various forms of work are shown in Fig. 488. In the example at *A* the work is a silver plate which is to be perforated in order to make a border as indicated at *B*. In punching work of this sort the plate is mounted on an indexing fixture and a section of the border as shown at *B* is punched at each index. At each stroke of the press the indexing mechanism operates so that the plate is turned around and positioned for the next operation. The turning of the work may be done by hand, or it may be operated automatically so that each stroke of the press indexes it. This arrangement would be dependent upon the nature of the work and the number of pieces to be produced. A simple method of indexing can readily be devised for the purpose.

Another example of a piece of work which requires an indexing operation is shown at *C*. This work is an armature disk and the slots to be cut are oblong in shape. When the arrangement of these slots is such that they can be cut in one operation the work is very often done in this manner, although in some cases it is found necessary to punch one or two slots at a time and index the work accordingly. In the example shown the slot *D* is pierced and the work is revolved so that the slot *E* comes under the punch, and the subsequent slots are punched in like manner. The indexing can be done automatically by each stroke of the press or by hand as may be required.

There are special presses on the market for work of this kind so arranged that they can be adjusted to take a considerable range of work within their capacity. When machines of this type are used it is necessary to make up suitable dies and an arbor on which the work can be located. Adjustments are provided so that the center of the arbor can be varied in relation to the ram of the press, thus making it possible to punch work of different diameters without difficulty. The indexing operation is automatically performed at each stroke of the press.

In perforating a cylindrical or formed shape of work like that shown at *F* the method of piercing and the construction of the die are somewhat different from standard practice. The work is slipped over an arbor or a mandrel *G* on which it is free to turn. There is some provision made usually for turning the work, and in the case shown there is a square hole in the end in which the plug locates and turns the work after each

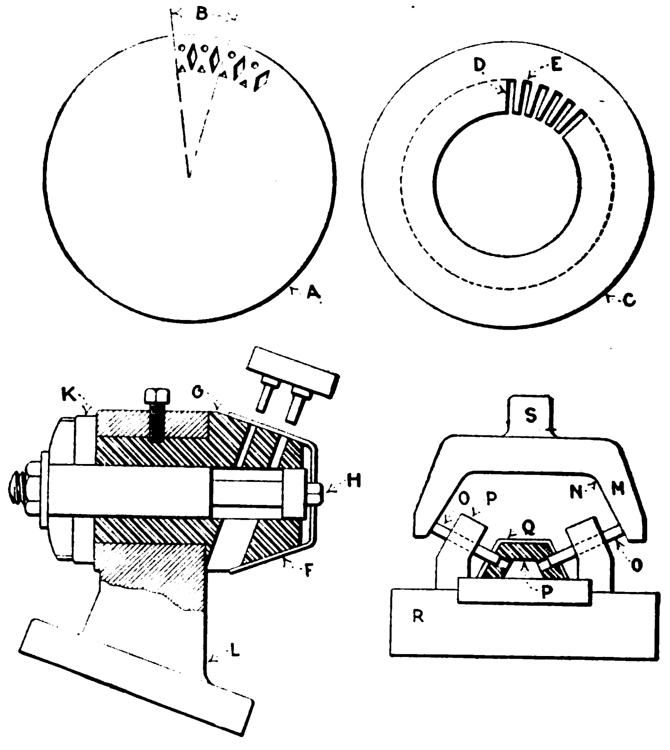


FIG. 488—PIERCING OPERATIONS REQUIRING INDEXING

stroke of the press, by means of the ratchet *K*. The base of the fixture *L* is of cast-iron construction and the illustration clearly shows the operation.

It may be necessary occasionally to provide some means for holding the work on the die so that it will not slip off during the indexing operation. Such an arrange-

ment can easily be made, but it is dependent naturally upon the shape of the work to be punched. There are cases when it is possible to pierce a number of holes in a piece of work with one movement of the punch, but this is not always advisable and a great deal depends upon the nature of the work and the accuracy required.

The punch shown at *M* has an angular face *N*. The

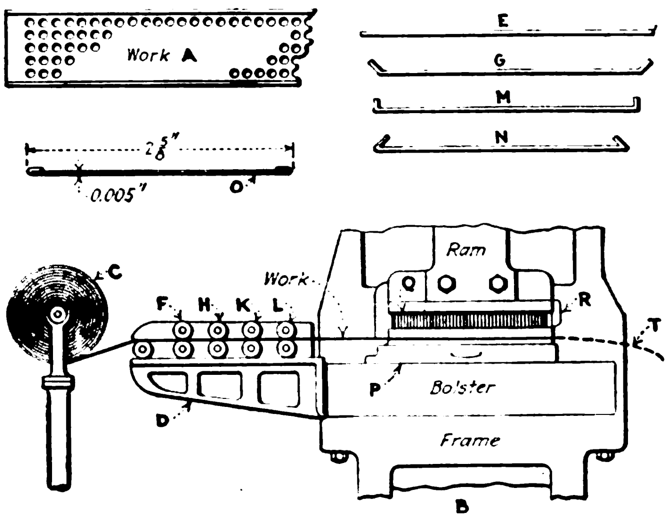


FIG. 489—PIERCING TOOLS FOR RADIATOR FIN

punch is made of steel and finished to the angular shape indicated. It is possible on very large work to make a holder of cast iron in which a steel piece of the required shape is inserted. The work *Q* is held on the die as shown, the latter being mounted in the shoe *R*. The punches *O* are located in accordance with the requirements of the holes on the rim of the work, and as the member *M* moves downward the punches are forced in through the sides of the piece, thus completing the operation. Suitable springs can be provided to return the punches to their original position after the piercing operation has taken place. The punch *M* is held in the usual manner by a shank *S* in the ram of the press. All wearing parts in a die of this sort must be very carefully fitted if accurate work is to be obtained. The thickness of the metal limits the use of this die, and it is only possible to utilize an arrangement of this sort on thin stock.

In Fig. 489 is shown in diagrammatic form the method of piercing a radiator fin. The work shown at *A* is made from 0.005 in. thick brass ribbon stock and there are 95 holes punched in it. The width of the finished work is 2$\frac{5}{8}$ in., while the length is 19 in. It is necessary to turn over or bead the end of the fin, and the die shown combines this operation with the piercing work and at the same time cuts off the piece to size. The diagram *B* shows the general arrangement of this die. The ribbon stock *C* is held on a reel as shown, and from this it is fed through a series of rolls which are mounted on a bracket *D* of special design, attached to the bolster plate of the press. The appearance of the stock before passing through the rolls is shown at *E*, and after passing between the rolls *F* the two ends are turned up at a 45 deg. angle as indicated at *G*. After this, a continuation of the feeding movement carries the work through the rolls *H*, *K* and *L*, which successively form the material into the shapes shown at *M*, *N* and *O*. In the last roll the shaping is completely finished and the bead turned over, while the stock is reduced to the required width of 2$\frac{5}{8}$ in. at the same time.

As the stock continues to move forward it passes over the die *P*, so that it is pierced by the punches at *Q*. The cut-off plate *R* is mounted on the punchholder so that it shears the previously pierced piece of work. The method of feeding the stock through the machine is by an automatic friction feeding device which is not shown in the illustration. In this example the stock moves very rapidly and the production is approximately 90 pieces per minute. The finished work drops off the machine after it has been cut off, as indicated by the dotted line at *T*. A suitable box can be attached to the press in such a way that the work will pile up in it and be ready for any further operation. This is an excellent example of modern piercing die construction.

Among the blanking dies described in a previous article we gave an example of a die for blanking a key and the general method of manufacture was also described. After the blanking is finished the piercing operation is to be done, and Fig. 490 illustrates the dies used for this piercing operation. The construction of

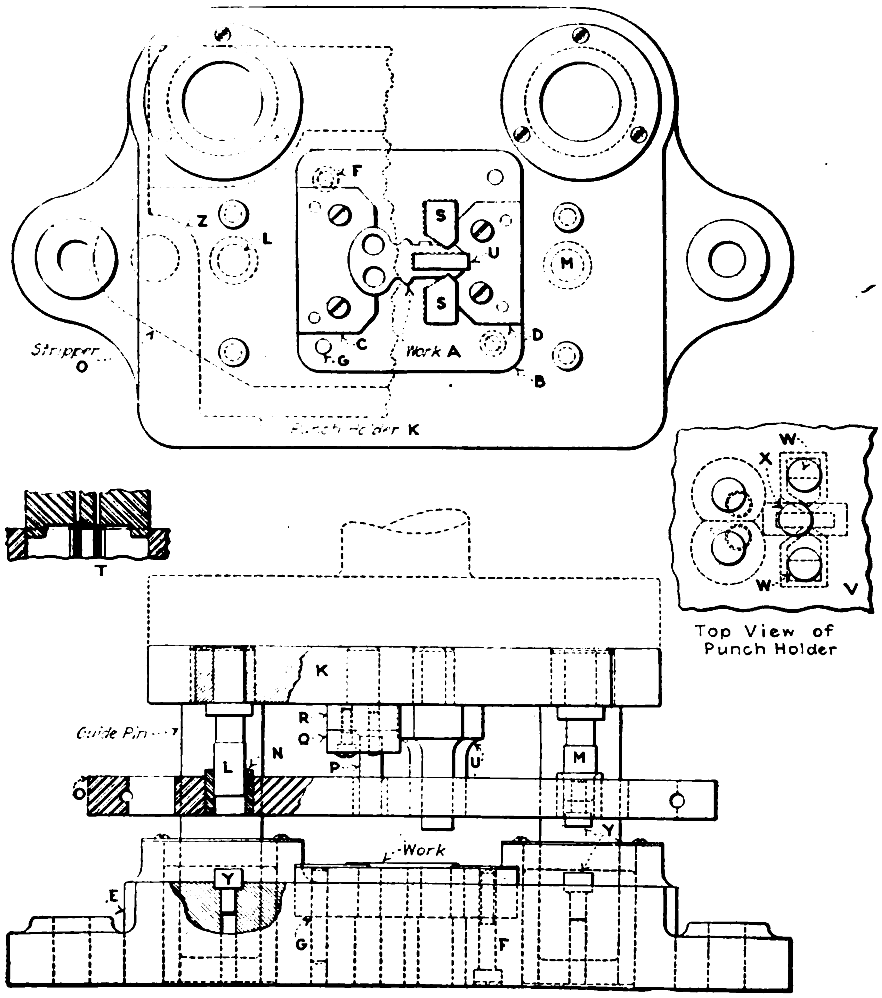


FIG. 490—PIERCING DIE FOR KEY

this die can be very readily understood from the illustration, and several points will be noted in the design which have been spoken of. The work shown at *A* is located on a die block *B* and nested at one end by the set edge *C* and at the other end by the set edge *D*. Button dies cannot be used in this particular case because the holes are too close together. The die block is mounted in a die shoe *E* and held in place by the screws *F*. Location is obtained by means of dowels shown at *G*.

This punch and die are of the sub-press or pillar type and a cam stripper like that previously described is used. The punch holder *K* has two stripper guide pins *L* and *M* which fit into the bushings *N* mounted in the cam stripper *O*. The punches *P* which pierce the two holes are of wire-punch construction, being held by the plate *Q* and holder *R* as indicated. The two punches *S* used for notching the end of the key are backed up in the die block by means of a "heel" which enters the die before the notching operation takes place. The importance of this point has been shown in a previous illustration. The view at *T* shows the construction of the punches more clearly, and illustrates the principle by showing the heel just entering the die block and the notching portion of the punches striking the work. The punch shown at *U* is used for cutting the slot at the center of the key.

Method of Holding Punches and Provisions for Grinding Punches and Dies

At *V* a top view is shown of the punch holder to bring out the general arrangement of holding the punches. The two wire punches used for the holes at one end of the key are off center from the hole. This is often done when holes are close together. The two punches for notching are held in the holder by means of the shank *W* and the punch for the elongated slot is also held by the shank shown at *X*. All these punches are made with flanges, and portions of the flanges are cut away so that the punches interlock each other, thus eliminating the use of locating pins.

One of the features in this die which has not been previously mentioned is the use of leveling studs *Y*, which are mounted on the cam stripper and the die block. The purpose of these leveling studs is to bring up the cam stripper on the downward stroke, so that as the punches descend through it they will be rigidly supported without any chance for them to become forced out of alignment. When the dies become worn so that it is necessary to regrind them the top of the leveling studs must also be reground, and as the studs and die blocks are of the same height it is very easy to place them all on the grinding machine and grind both parts at the same time.

When the punches are to be ground it is unnecessary to grind the leveling studs, as the amount of adjustment necessary to compensate for the stock ground from the punches can be very easily made in the press. The outline of the punch holder in the plan view shows a portion of it cut away at *Z*, which is done to provide ample clearance for the pins which hold the cam stripper. Both cam stripper and punch holder in this view are shown by dotted lines.

It has been our endeavor in this article on piercing dies to illustrate fundamental principles and show graphically the various points of importance in connection with their design.

Ventilation

The report of the New York Commissions on Ventilation, to be published by E. P. Dutton & Co., Jan. 1, 1923, will be in two parts in one volume. The first part will deal with the physiological aspects of ventilation with a review of historical developments in physiological influences of ventilation. The preliminary experiments were conducted in a specially designed laboratory and covered a period extending from December, 1913 to January, 1916 and used 113 persons as subjects.

The second part will deal with the mechanical phases of ventilation, data for which were obtained from work in the period extending from 1915 to early in 1917. Included is a review of historical developments in ventilation and a report on different methods of ventilation of school rooms.

Among the subjects covered are: Effects of overheating, carbon dioxide, exposure to drafts, dry air at moderate temperatures, rooms ventilated by windows supplemented by exhaust flues, fans supplemented by exhaust flues, fans (both supply and exhaust), using the same air over again after re-conditioning, studies of different types of ventilation in schools.

The following is an abstract of the conclusions:

Physical and chemical characterization of air affect health and efficiency, but physical condition of air, particularly as it relates to its temperature, is the factor of prime importance. Moderate and high temperatures (75 and 86 degrees) combined with high humidities, tend to interfere with the normal function of heat loss which gives rise to discomfort. A high moisture content of the air, especially when the air is warm, mitigates against heat loss through the evaporation of water from the skin. A high humidity will therefore reinforce the harmful action of a high temperature.

Vitiated Air To Be Avoided

As compared with fresh air at the same temperature, vitiated air reduced the performance of physical work. The second and more important effect was on the appetite for food. The appetite was found to be measurably and definitely decreased as a result of breathing stale air. The primary essential for good ventilation is the maintenance of a proper air temperature of 68 degrees or below, but without the production of chilling drafts. At the same time, there should be an air change sufficient to avoid the accumulation of odoriferous or other substances arising from human occupancy. The use of windows for ventilating purposes without a suitable means of exhaust for the vitiated air was found wholly impractical. The ventilation of the schoolroom by the use of window inlets and gravity exhaust gave much more satisfactory results. Ventilation by the use of fans and gravity exhaust was found to give better results than any form of window ventilation insofar as the aeration of the room was concerned.

The commission points out that the nature and environment of the enclosure to be ventilated dictate the method of ventilation to be used, and that what is adequate for one type of building may be inadequate for another. Theatres and auditoria, for example, must generally rely on fan systems. Window ventilation would prove inadequate for a school which is overcrowded.

The report states, finally, that the avoidance of overheating is the primary essential of all systems of ventilation and that the most important article of ventilation equipment is the thermometer.

TABLE XII

Switzerland—Imports of Machinery for Working Metal, Wood, Stone, etc.

Country	1909 Quantity q.n.	1909 Value Francs	1910 Quantity q.n.	1910 Value Francs	1911 Quantity q.n.	1911 Value Francs	1912 Quantity q.n.	1912 Value Francs	1913 Quantity q.n.	1913 Value Francs	1914 Quantity q.n.	1914 Value Francs	1915 Quantity q.n.	1915 Value Francs
Germany	27,787	3,708,838	27,825	4,148,354	32,413	4,588,790	35,427	5,116,763	32,834	4,779,723	20,862	3,051,229	8,313	1,259,276
Austria-Hungary	525	57,746	188	19,310	219	22,519	207	27,426	154	18,839	134	18,742	58	5,515
France	587	104,289	871	149,774	1,463	206,408	1,378	265,326	1,097	206,959	2,100	318,928	918	135,166
Italy	258	55,416	208	36,382	257	35,395	171	27,234	125	11,103	39	7,478	41	7,465
Belgium	503	81,223	153	15,825	215	37,950	153	27,460	342	32,170	174	20,272	280	17,630
Netherlands	8	1,040	1	300	44	10,090	2	660	10	2,683	......	....	17	3,744
Great Britain	785	144,007	780	211,496	845	152,261	1,052	201,311	962	245,644	536	111,247	130	34,452
Sweden	88	15,304	22	3,615	186	40,317	190	48,464	54	11,705	96	20,730	10	1,900
Denmark	1	94	......	....	7	1,500	6	1,200	......	....	38	3,970	......	....
United States of America	1,797	460,858	1,901	479,495	2,450	674,832	4,942	1,218,331	3,092	895,388	2,319	572,486	1,969	631,060
All other countries	......	100	......	25	......	300	4	380	......	....	1	90	2	350
Total	32,339	4,628,915	31,949	5,064,576	38,099	5,770,362	43,532	6,934,555	38,670	6,204,214	26,299	4,125,172	11,738	2,096,558

Country	1916 Quantity q.n.	1916 Value Francs	1917 Quantity q.n.	1917 Value Francs	1918 Quantity q.n.	1918 Value Francs	1919 Quantity q.n.	1919 Value Francs	1920 Quantity q.n.	1920 Value Francs	1921 Quantity q.n.	1921 Value Francs
Germany	19,656	2,958,467	7,999	1,580,130	7,370	1,780,703	54,022	12,336,733	105,457	19,300,232	38,563	7,295,000
Austria-Hungary	218	23,530	51	15,472	......	....	1,059	141,874	686	139,556	922	151,000
France	2,235	470,330	516	199,207	65	47,085	538	200,062	1,272	502,207	932	302,000
Italy	20	6,795	18	7,000	......	....	71	11,420	298	56,740	123	57,000
Belgium	20	1,600	26	5,212	......	....	110	26,550	243	75,274	22	11,000
Netherlands	3	533	......	....	......	....	1	1,000	17	21,245	17	2,000
Great Britain	176	47,141	488	209,013	314	78,210	94	77,317	616	354,966	426	140,000
Sweden	64	15,270	69	38,552	199	137,626	466	253,535	175	62,266	......	....
Denmark	......	....	292	129,275	......	....	9	2,008	4	1,180	......	....
United States of America	4,093	1,465,188	8,447	4,052,082	3,669	1,807,383	3,852	2,074,362	3,080	1,750,717	657	305,000
Czecho-Slovakia	......	....	......	....	......	....	......	....	19	1,489	44	4,000
All other countries	......	....	3	482	......	....	......	....	7	2,000	15	3,000
Total	26,485	4,988,854	17,909	6,236,425	11,617	3,851,007	60,222	15,124,853	111,874	22,267,872	41,721	8,270,000

Value of Franc at parity is 19.30c
q.n. = net quintals or 109 kilograms = 220.46 lb.

TABLE XIII

Chile—Imports of Machine Lathes

"Tornos Mecanicos, Varios"

Country of Origin	1912 Quantity Number	1912 Value Pesos	1913 Quantity Kilos	1913 Value Pesos	1914 Quantity Kilos	1914 Value Pesos	1915 Quantity Kilos	1915 Value Pesos	1916 Quantity Kilos	1916 Value Pesos	1917 Quantity Kilos	1917 Value Pesos	1918 Quantity Kilos	1918 Value Pesos	1919 Quantity Kilos	1919 Value Pesos	1920 Quantity Kilos	1920 Value Pesos
Great Britain	6	3,811	26,360	10,544	9,585	3,834	930	372	1,770	750	1,513	1,807	392	300	5,689	7,512	51,390	80,989
Germany	3	1,309	26,230	10,492	5,155	2,062	....	....	....	....	....	....	....	....	....	....	6,002	7,593
United States of America	4	1,609	5,450	2,180	7,280	2,912	5,350	2,140	4,208	6,396	68,071	111,556	79,014	157,571	36,349	84,387	65,174	84,566
France	....	....	225	90	40	16	....	....	....	....	97	362	....	....	....	....	2,224	4,201
Belgium	....	....	370	148	....	....	....	....	....	....	....	....	....	....	....	....	....	....
Argentine Republic	....	....	....	....	165	66	....	....	....	....	119	174	10,897	30,727	....	....	100	686
Italy	....	....	....	....	....	....	735	294	....	....	....	....	....	....	....	....	1,400	9,710
Total of Imports	13	6,729	58,635	23,454	22,225	8,890	7,015	2,806	5,978	7,146	69,800	113,899	90,303	188,598	42,038	91,899	126,200	187,745

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Power Required for Shearing Machines

By John S. Watts

The formula given in most textbooks for determining the horsepower required to operate a shearing machine is obtained as follows: First, to determine the force required to shear the maximum size of bar, multiply the sectional area of the bar by its ultimate stress per square inch in shear. For instance, to shear a 4-in. square bar of soft steel having a shearing stress of 50,000 lb. per square inch, will require $50,000 \times 16 = 800,000$ lb. This force is assumed to act through a distance equal to the height of the bar, which in this case will be 4 in. or one-third of a foot; and the work performed each stroke will be $800,000 \times \frac{1}{3} = 266,667$ ft.-lb. At twenty strokes per minute the horsepower needed is

$$HP = \frac{266,667 \times 20}{33,000} = 162.$$

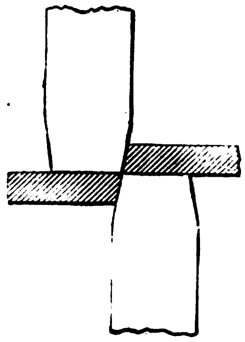
Experience with actual machines shows that this horsepower is very much in excess of that actually used, a 30-hp. motor being quite capable of running the above-mentioned size of machine, which proves that the calculations are incorrect or are based upon erroneous assumptions. Going over the calculations again, we find that there are only two of the factors which can be incorrect, namely, the shearing stress, and the assumption that the full shearing force has to be exerted through a distance equal to the height of the bar. The shearing strength of soft steel, which is taken at 50,000 lb. per square inch, does not in actual practice vary much from this figure. Therefore, it is clear that the error does not lie with this factor, but that we must look for it in the other one.

Consideration of the action of the shear knives shows us that the shearing force cannot but decrease as the knives cut through the bar; and observation of the shearing of large bars proves that the bar is actually sheared completely off long before the moving knife has traveled to the lower edge of the bar. Unfortunately, the forces exerted in shearing are so high and fluctuate with such rapidity during the stroke that it is impossible to devise any means of accurate measurement of them on an actual machine, and we have to depend upon what information we can gather from analysis of the action of the bar being cut.

Let us see what data we can assemble from such a study. If the shear blades were infinitely thin, and cut off the steel by cutting through it, as we would cut off a slice of bread from a loaf, the amount of force needed would be only that required to force the knife into the bar; but this force would be constant until the knife had passed through the bar. On the contrary, the knives have to be of appreciable thickness to stand up to the work; and if it were not for the bar deforming under the pressure, it would be sheared off completely very soon after the knife had come in contact with the upper side of the bar. That is, if the bar did not become deformed before being completely sheared, the force required would be equal to the area of the bar multiplied by its shearing strength; but this force would be exerted only momentarily, and not for the whole depth of the bar.

Anyone who has seen high-carbon steel being sheared will have noticed that the piece being sheared off flies off almost as soon as the knife touches it, with a sound like that from a cannon being fired. What actually occurs is that the knife first compresses or deforms the bar, until the compression has reached a point where further deformation would require a force greater than that needed to shear the bar. At this stage shearing commences and is continued until the molecules of steel are torn apart, or forced past each other to cause a break.

The textbooks to the contrary notwithstanding, it needs no more than a look at a bar which has been sheared, to know that the actual shearing has been done in a small fraction of the stroke. For any resistance to shear to last while the knife travels the full depth of the bar, would mean that there was still cohesion between the two sections of the bar when the sheared bar was as shown in the sketch herewith, which is absurd. For the whole shearing force to be required during the full travel of the knife past the bar, as assumed by the textbooks, would require us to believe that the whole sectional area of the bar being sheared still retained its full shearing strength when the knife was in the position shown, which is still more absurd.



KNIVES FINISHING SHEARING CUT

It is common practice among those familiar through experience with shearing machines to assume that the full shearing force lasts during a distance of one-half the thickness of the material being sheared. While this may be approximately correct for thin material, it is obviously not so for bars, say, 4 in. thick, as the bar is sheared off long before the knife has passed 2 in. into it. From observation and experiment I find that in shearing or punching soft steel, there is first a certain amount of deformation takes place, which under like conditions varies about as the thickness of the material being sheared. By amount of deformation I mean the distance traveled by the knife from its first contact with the bar until it actually begins to cut. This travel is, of course, greater when cutting large square bars with plain knives, than it will be if the knives are notched to fit the bar. The actual shearing after deformation is completed is done practically instantaneously.

The amount of this deformation can be measured on the sheared bars and is found to be approximately

one-quarter of the height. The force required to produce this deformation is necessarily less than would be needed to shear the piece, but is probably not much below it, and the error will be on the safe side if we assume it to be equal to the shearing stress. The conclusion arrived at is that in the formula for the horsepower given in the beginning of this article we should use one-quarter of the thickness of the bar in feet, instead of the whole thickness, and it will be found that the horsepower so calculated will agree quite closely with that commonly used.

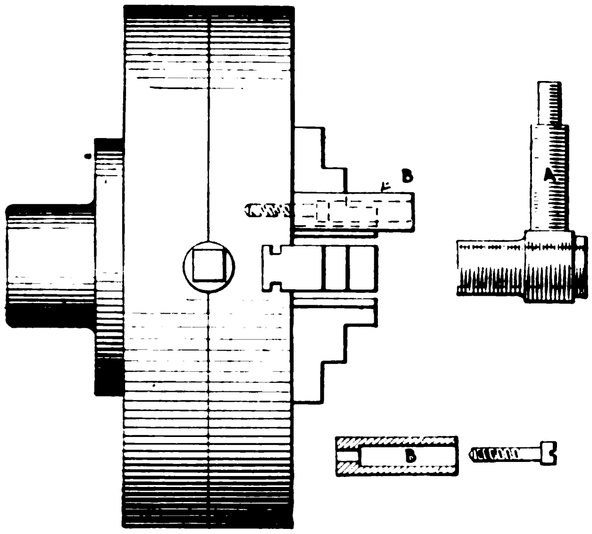
To the horsepower so calculated must be added sufficient to cover the power required to overcome the friction of the machine running idle. This power does not appear to vary in proportion to the capacity of the machine, being very little more for a large machine than it is for a small one, but differing more with the different types of machines. This can be best determined from measurement of the power consumption of a similar machine, but may be taken as around 3 hp. on small machines and up to 5 hp. on the larger ones.

When used for punching there is additional power required in stripping, that is, for pulling the punch out of the hole after punching. This averages about one-half of the power required to punch the hole, if the punches and dies are sharp and in good alignment; if in bad condition the stripping may consume as much power as the punching.

A Lathe Kink

By Walter Kaufman

A simple expedient for driving a piece of work that was difficult to hold is shown in the accompanying sketch. The part *A*, to be machined, is of brass and requires a hole to be drilled and reamed through the hub. As the part is so light and the wall of the finished



DRIVING STUD ATTACHED TO LATHE CHUCK

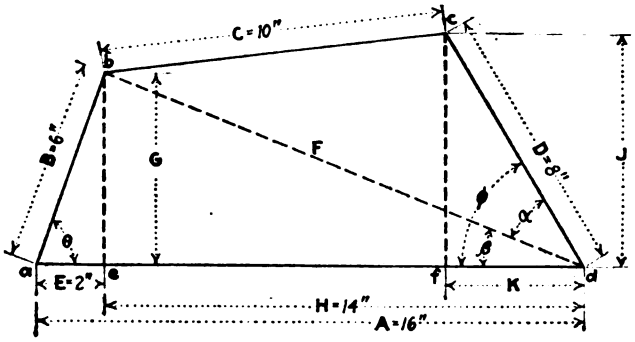
hub so thin, it was impossible to grip it with sufficient force to prevent slippage without distorting it.

To overcome the trouble we drilled out a piece of round cold rolled steel as shown at *B* and attached it to the face of the chuck by tapping a small hole in the latter between two of the jaws. This "stud" now protrudes beyond the chuck jaws and the arm of the work lies against it, thus furnishing the driving power while the chuck jaws have only to hold the work central.

An Interesting Shop Problem

By H. W. Hardy

Four shafts were to be spaced with their centers at *a, b, c* and *d,* as shown in the accompanying illustration. The distances *B, C, D, E* and *A* were given, and the distances *G* and *J* had to be found. By joining the centers *bd,* the two triangles *abd* and *bcd* are formed, and by dropping perpendiculars from *b* and *c* cutting



AN INTERESTING SHOP PROBLEM

the line *ad* at *e* and *f,* three more triangles, *abe, bde* and *cdf* are formed. These triangles may be solved by trigonometry for any side or angle.

From the triangle *abe* we get

$$\frac{E}{B} = \cos \theta \qquad (1)$$

$$G = B \sin \theta. \qquad (2)$$

From the triangle *bde* we get

$$\operatorname{Tan} \beta = \frac{H}{G}. \qquad (3)$$

From the triangle *abd,* by using the well-known formula

$$C = \sqrt{a^2 + b^2 - 2ba \cos C},$$

we get $F = \sqrt{B^2 + A^2 - 2BA \cos \theta}.$

From (1),

$$\cos \theta = \frac{E}{B}$$

and $F = \sqrt{B^2 + A^2 - 2EA}. \qquad (4)$

From the triangle *bcd,* we get, by employing the formula

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab},$$

$$\cos \alpha = \frac{D^2 + F^2 - C^2}{2DF}.$$

Substituting the value for *F* from (4) we get

$$\operatorname{Cos} \alpha = \frac{D^2 + B^2 + A^2 - 2EA - C^2}{2D\sqrt{B^2 + A^2 - 2EA}}. \qquad (5)$$

From the triangle *cdf* we get

$$\phi = \beta + \alpha \qquad (6)$$

$$\frac{K}{D} = \cos \phi;\; K = D \cos \phi \qquad (7)$$

$$\frac{J}{D} = \sin \phi;\; J = D \sin \phi \qquad (8)$$

Substituting the values given for *A, B, C, D* and *E* in the formulas, we get

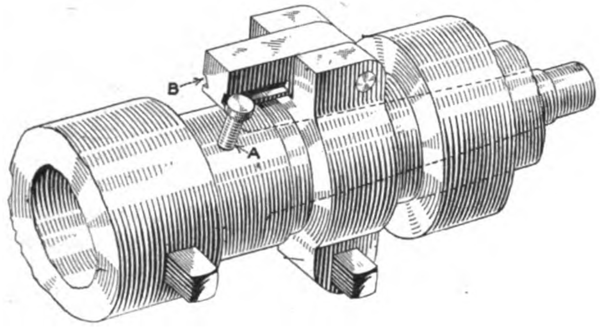
From (1) $\theta = 70$ deg., 32 min.
From (2) $G = 5.65698$ in.
From (3) $\beta = 22$ deg.
From (5) $\alpha = 37$ deg., 22 min.
From (6) $\phi = 59$ deg., 22 min.
From (7) $K = 4.07633$ in.
From (8) $J = 6.88352$ inches.

Holding a Drill Chuck in the Tail Spindle of a Lathe

By W. H. Storey

On page 233 of the *American Machinist*, Charles Kaufmann describes a method of preventing a drill chuck from slipping in the tail spindle of the lathe. At the end of his article he cautions the reader to make the head of the clamping screw of the driving ring the same size as the head of the toolpost screw.

It will be obvious from that caution and also from his illustration that the device has to be removed often; i.e. removed each time a tool other than the chuck is used. It would seem to me that the driving ring would have to be made much wider than he shows it if it is to have a greater driving effect than the long taper shank of the drill chuck.



HOLDING A CHUCK IN LATHE SPINDLE

In the accompanying illustration the writer shows a chuck driver which need never be removed from the tail spindle because the driving tail swings away to the back of the machine. It will be obvious that this device can be operated in a fraction of the time required to pick up a key and loosen a screw and remove a collar. The driving tail is kept in driving position by the T-headed pin *A* which fits in the slots *B* in the tail whilst the chuck is in use. Two slots are provided so that tools with either right or left hand cutting edges can be held.

Valve Grinding—Continuous or Reciprocating

By H. R. Fowler

A discussion recently arose in the shop as to the best method of "grinding in" valves, particularly referring to fairly good sized steam governor valves, which were being ground in by hand. The man was following the traditional way of grinding, which our grandfather's probably used—a reciprocating motion of the valve *less than a full turn*, a certain number of times, which varied at the fancy of the man—lift the valve clear of the seat—revolve a quarter turn—replace on seat and repeat.

What is the theory of these motions? Do we lift the valve clear of the seat, for any reason except to allow the abrasive to get between the surfaces again? And if that is so, why the reciprocating motion—why not keep the valve revolving in a continuous direction, and possibly get just as good a seat, in less time, provided the valve was lifted from the seat for an instant, every 3 or 4 revolutions?

A certain valve shop has a whole battery of "grasshopper" machines, imitating the old hand method of grinding in seats of globe valves. To be sure the seats are right, but that does not necessarily prove that it is the quickest and best way.

Some of the automobile companies in their instruction books, recommend that in regrinding valves the old conventional way be followed. The continuously revolving way is certainly easier, if done right, than the other way. I've tried it, and would like to hear some one else's opinion on the subject.

[The theory is that by the latter method you correct any "out-of-roundness" in a valve or its seat or both. With valves and seats which are really round, as we now produce them, there seems to be little doubt as to the continuous grinding being just as satisfactory. Editor.]

Holding a Drill on the Center

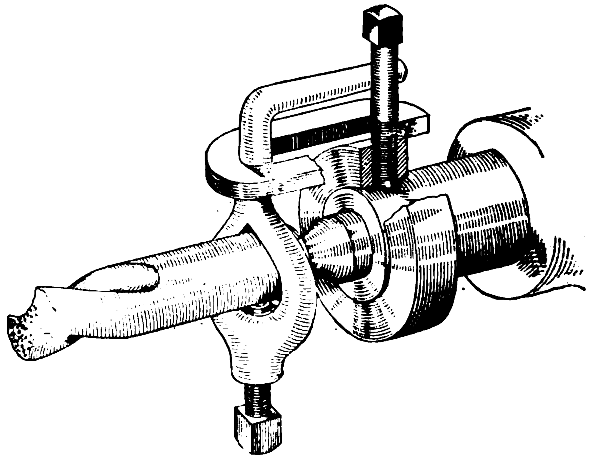
By Harry Moore

A drill hold-back that works very well and does not cost much to make is shown in the accompanying illustration.

The principal part is the collar, which should be fitted nicely upon the end of the tail spindle where it is held by the long screw. A pad or shoe of brass should be placed under the screw to avoid marring the surface of the spindle. The body of the screw acts as the stop against which the tail of the dog rests when the drill is at work.

Slip a lathe dog loosely upon the shank of the drill and put the latter in the lathe with the point against the work and the shank end upon the tail center. Place a link or washer over the body of the long screw and allow it to encircle the tail of the dog also; then move the dog along the drill shank until the "slack" is all taken up and then tighten the dog screw.

As long as the drill is in the work the shank cannot slip off the center because it will be held by the link, but when the drill is withdrawn it may be lifted out of the lathe without loosening a screw or disturbing the position of any part. One adjustment of the dog will, therefore, answer for many drillings and, as the link positively prevents the shank from slipping off the center, the attention of the operator may remain where it should be—upon the work—an advantage that even a highly skilled man will appreciate.



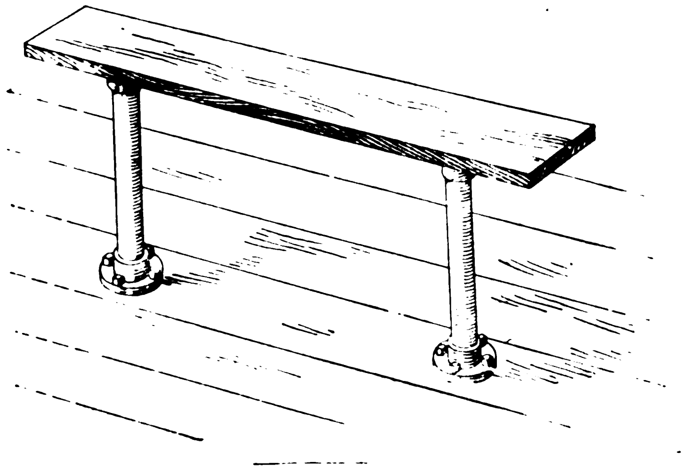
HOLDING A DRILL ON THE CENTER

A Convenient Bench for the Repair Shop

By G. A. Luers

The bench illustrated by the sketch is of a convenient type for the repair shop and is suitable for the heaviest driving and fitting work. It is compact enough not to encroach unduly upon the floor space and it embodies simplicity of construction along with dependable rigidity. Two 3-ft. lengths of 4-in. pipe with flanges at each end form the footing for a 2-in. oak top 14 in. wide and 7 ft. long.

A local shop specializing in the repair and maintenance of heavy trucks uses this type of bench for handling truck parts. Some of these benches are fitted with vises while others are fitted with straightening clamps and gear pullers. The main advantage is that the bench withstands a considerable amount of pounding and driving. The renewal of the top in the event of its breaking is only a matter of obtaining a ready cut section from the nearest lumber yard.



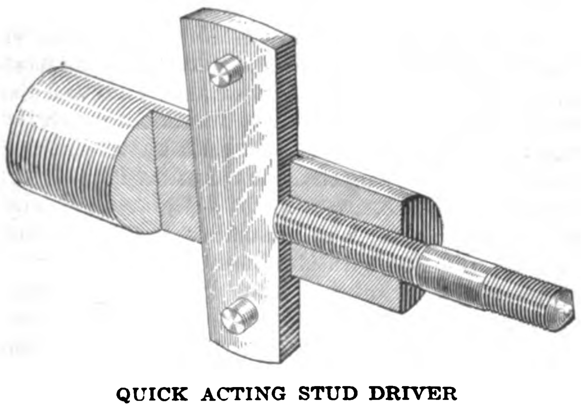
A BENCH FOR THE CENTER OF THE SHOP FLOOR
PORTABLB BENCH MADE FROM SHEET METAL AND PIPE

A Quick Acting Stud Driver

By Lee Jackson

Some machine shop operations have not changed in a good many years. At least, not in some shops. For instance: for the last twenty years I have seen studs inserted with just one kind of a driver. That was a piece of hexagon stock with one end tapped to receive the stud, and the other to receive the locking set screw. This driver was placed on a stud and used as a wrench grip to screw it in place, then it usually required two wrenches to remove the driver from the stud.

But, the other day I saw what to me was a brand new idea in a stud driver. It was made from a piece of round steel about 15 in. long and had a smaller piece of round steel about a foot long through the upper end for a handle. In this respect it resembled a socket wrench. The lower end was tapped to fit a stud and a wedge of hardened steel inset in a rectangular hole through the driver so it would slide endwise freely was used as a lock. But it worked as smoothly as a worn out file. Studs were inserted about as fast as nuts are ordinarily put on as no time was lost in removing the driver. When a stud was tight a tap on the small end of the wedge loosened the driver and the tool was spun off. The accompanying sketch shows the business end of the driver. The shank and handle you can provide to suit your needs.

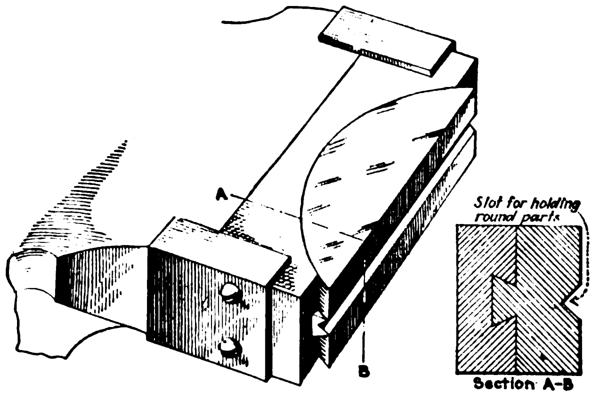


QUICK ACTING STUD DRIVER

Self-Aligning Vise Jaw

By G. A. Luers

While the ordinary bench vise is an admirable all-round tool for holding most of the work that comes to it, there are times when tapered keys, shafts or other parts (the opposite sides of which are not parallel) are to be worked upon and then the vise is useless without



AUXILIARY VISE JAW FOR HOLDING TAPERS

cobbling it up with loose pieces to make up for the inequality. Machinists who have tried to hold such work in the vise and fervently wished for three hands with which to accomplish the job will appreciate the advantage of the simple auxiliary jaw shown in the appended sketch.

A block of suitable material is clamped to the faceplate of a lathe, the inner face bored to a large radius, and a dovetail groove machined in it. Another block of steel is then so clamped to the faceplate that when turned its convex surface and the tang to fit the groove machined upon its radii will match those of the first block. The flat surface of thesecond block ma be checked if desired to match the face of the movable jaw of the vise, and a V-groove should be planed along it, as shown, to facilitate the holding of round tapered work.

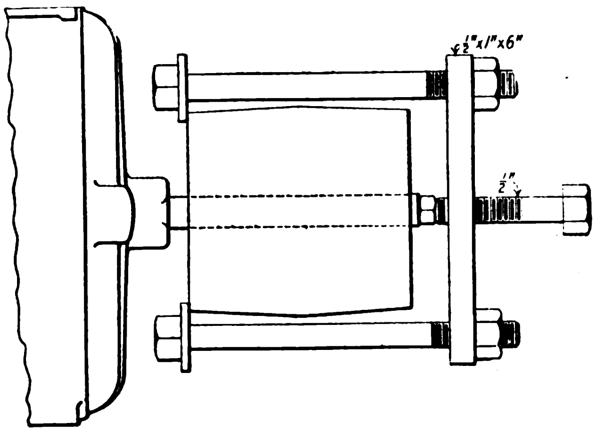
The end pieces to retain the device in position may be made of heavy sheet metal and fastened to the block with countersunk head screws. This little appliance has saved no end of trouble and is one that can be made up in any shop, on account of its simplicity.

Puller for Small Motor Pulleys

By Waller L. Kaufmann

We have several one-quarter horsepower motors in our shops which have small cast-iron pulleys, about 3 in. in diameter. When repairing one of these motors the other day I found the pulley had been put on very tight, and not having a puller I made the little device shown in the sketch in a very few minutes.

I took a piece of steel about ½ in. x 1 in. in section and



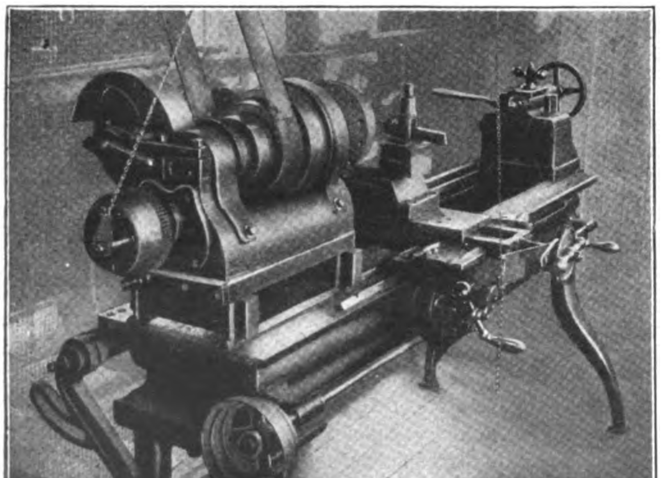
IMPROVISED PULLER FOR SMALL MOTOR PULLEYS

about 5 in. or 6 in. long, and drilled two ½-in. holes far enough apart to span the pulley. I then drilled and tapped a hole between these two for a ½ or ⅝-in. cap screw. Then by putting two ½-in. bolts in the two outside holes, as shown in the sketch, with washers to hook under the edges of the pulley, it was pulled off quickly and easily. A nut was put between the armature shaft and the cap screw so the center would not be spoiled.

Power Crossfeed for Old Lathe

By William Clancy

The illustration shows an old lathe, resurrected for use in a small garage, that has been fitted with a power



IMPROVISED CROSSFEED

cross feed to enable the garage man to attend to other jobs while the lathe is taking a facing cut.

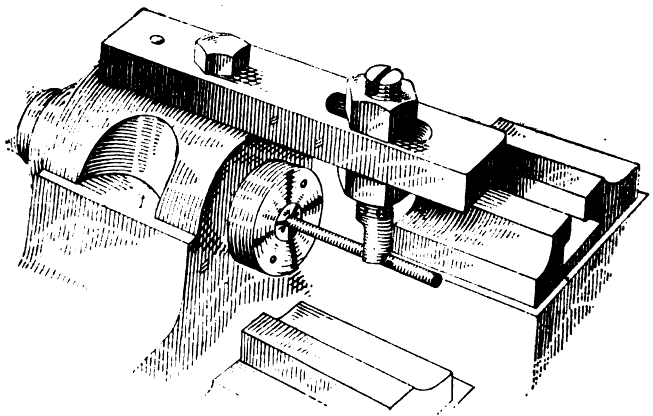
All of the parts used except the chain either came out of the scrap or were parts of the lathe. The bushing through which the crossfeed screw passes was shortened to expose a sufficient length of the screw to allow for keying on one of the change gears and also to make room for the ratchet lever, which is a piece of cold rolled sheet steel, bent to the desired shape.

The end of the ratchet lever is slotted to allow a link of the chain to slip in sidewise, and the effective length of the chain may thus be increased or shortened to meet requirements. Any change gear on the lathe may be used as a ratchet and, as the diameter of the gear is a factor in the resulting movement, the amount of feed per revolution may be graduated to very small increments by using a large gear. The casting upon the change gear stud has a familiar appearance to one who is acquainted with automobile repair shops and is slotted to receive a driving stud. The position of the driving stud may be changed from central to any part of the slot. To reverse the direction of the feed it is necessary only to flop the ratchet lever over to the other side of the gear and turn over the pawl. Except for the odd moments spent in its devising, the whole bill of expense probably did not exceed twenty-five cents.

Steady Rest for Small Automatic Screw Machines

By Edward A. Hazen

In drilling holes in the end of small work made from bar stock in the automatic screw machine, difficulty is often encountered in getting the drill to start centrally owing to the slenderness of the work and its consequent liability to "dodge" when the drill comes into action.



STEADY REST FOR SMALL WORK

The sketch shows a steady rest that I made for the No. 00 Brown & Sharpe automatic to overcome this trouble.

A piece of flat stock is bolted to the main spindle-bearing cap to project over and parallel to the work. An elongated hole near the end of this piece receives the round steady rest, which is threaded nearly its full length and provided with two nuts by which it may be adjusted to and clamped at any desired height. The bar carrying the steady rest must be high enough above the tool blocks on the cross slide that the cross slide tools will pass under it with out interference.

The lower end of this piece is flatted off and a half hole made in it as shown, to match the diameter of the work, or it may be notched to an inverted V-shape to accommodate a range of sizes.

Editorial

THERE ARE FOUR varieties of workers and we find all four kinds in almost every shop. Some are slow and do poor work; some do the work just as poorly but produce more; some are slow but do good work and a few do the work both well and fast. Why should all get the same pay? What incentive is there for the good man to give the world the benefit of his greater capacity if the world gives no more to him than to his poorest brother? Don't forget that, even when a man is paid according to what he produces, he who gets the highest pay will still be the cheapest man.

Investing Money to Improve Machine Work

THE MANUFACTURER who earnestly desires to turn out the very best product in his field, is beset with many difficult problems. The greatest problem is perhaps financial rather than mechanical. A case in point is that of a maker of special cutters of a type that is still far from perfect even though they have been used for many years.

A large user of this particular kind of cutter has made extensive experiments and developed a standard which has given the best results. The standard is not easy to make and most of the makers of this kind of cutter have made no serious attempts to follow it. They make cutters galore to be tried out, but fail to conform to the standard.

One maker, however, and not one of the largest either, has made a careful study of the situation and has spent approximately $50,000 developing a method of making the cutters of the desired standard. And this in spite of the fact that the maximum business of this concern will not exceed $10,000 a year. Here is where the financial problem comes in.

The cutter maker is staking present expense against future orders, not only from the one concern but from others who will probably demand the special type of cutter later on. If the demand for better cutters materializes, as he evidently expects it will, he will be in a most advantageous position to supply them. But on the other hand he is perhaps running the risk that other firms, who have not invested $50,000 in experiment, will profit by his work along this line.

The chances are, however, that the knowledge and experience gained in this development will place him in a position to profit in the years to come. When it becomes known that he can furnish these special cutters with a certainty of their being right, users who are educated to the point of knowing what they require will not bother with experimenters. The man who knows how to make them should get the business—and it is to be hoped that the pioneer along this line will have his business so organized as to cash in on the large investment already made. He deserves a rich reward for his courage and his efforts to better machine production, and there can be no question as to his being in the most advantageous position to secure new business.

The Need of Federal Control of Aircraft

THOSE WHO are doubtful as to the coming of air transportation in the near future will do well to read the reports of the First National Air Institute meeting held in Detroit, Mich., and the proceedings of the Second National Aero Congress which followed it. Both of these documents are extremely interesting and show just where we stand in aviation. They also show where we can stand and ought to stand, if we are alive to the situation as it now exists.

As pointed out by Howard E. Coffin in his foreword, "No comprehensive, definite or continuing policy of aeronautical development can be had by us except through an orderly pressure of national sentiment resulting from an educated public mind. Federal laws, the control and regulation of all aircraft are of immediate and crying need. An authoritative Federal agency must be established to examine and license both pilots and aircraft in any commercial or private service. Federal inspection of all aircraft for airworthiness must be provided."

It is not at all creditable that we, the pioneers of aviation, are the only great nation which has not subscribed to the International Air Code which covers the points made by Mr. Coffin, our lack of participation being entirely due to a partisanship which comes very near being criminal. An American plane landing on Canadian soil or on Canadian waters, is practically an outlaw and has no standing. Nor is it permitted to resume its flight until it has been inspected for airworthiness and the pilot likewise examined. Such lack of co-operation, for which we are solely responsible, does much to hinder aviation along the border.

Progressive cities and towns are providing landing fields at convenient points. These should be near enough together to permit a pilot's reaching one of them in case of motor failure. The time is not far distant when these fields must be illuminated for night landing.

Aviation is here to stay. The rate of its development depends largely upon Federal control and the providing of landing fields. Every community can do its share to help it along—and it all makes business for the country.

Just Suppose

JUST SUPPOSE that you, as the manager of a small jobbing shop, had an emergency job come in that demanded of you certain technical information that you didn't have. Suppose further that you wrote to two concerns from either of which you would have bought the part needed if the case had not been one of emergency, and asked them to give you the information you wanted.

Now suppose that one of them sent it back by return mail while the other one hesitated a while and finally said it couldn't let you have it.

If somebody asked you to recommend one of these concerns, it doesn't take much supposing to guess that you would strain a point to recommend the one that wasn't afraid to come out of its shell, does it?

Shop Equipment News

Kobert Type-NB Dual-Head Electric Riveting Machine

The dual-head electric riveting machine made by the Kobert Machine Co., Inc., 50 Church St., New York, N. Y., has recently been redesigned, so that it appears as in Fig. 1, which gives a view of the Type-NB machine. The new model is, of course, similar to the former one and is distinct in type, since an upper tool of construction peculiar to the Kobert machine is employed.

A copper electrode is placed on the right, and a steel heading set on the left. Heating of the rivet is done by passing a current through it when resting on the horn and held down by the copper electrode. When the heat has progressed sufficiently, the head is moved laterally 1¼ in. to bring the steel heading set or ram over the work, which does not change its position. The head of the rivet is then formed under pressure. The machine is motor-driven to provide the necessary pressure on the work, and the control is provided by one pedal, so that the hands of the operator are free to manipulate the work. The machine is adaptable to a wide variety of work, both in its standard form and with special fixtures.

The overhanging column and base are one member, on which all parts of the machine are mounted. The horn or lower electrode is water-cooled, the water being circulated from a pipe line connected to the shop water supply. A screw is provided to vary the height of the horn. The construction is such that the entire front of the machine can be stripped, thus giving room for special fixtures to suit the work.

All rivets are heated in place; that is, they are assembled in the holes in the work and then placed on the horn of the machine. In this way, handling of hot rivets when inserting them in reamed holes is eliminated. By heating the rivet in place, the metal around the hole is expanded; and it contracts upon cooling, so as to make a very tight fit on the rivet. Electric heating does not cause oxidation and scaling of the rivets if proper care is given to the process.

The upper electrode also is water-cooled. The material is copper, since it has seven times the conductivity of steel. Both electrodes are connected to the transformer in the machine by means of heavy wire cables to reduce electrical resistance. There is no attempt made to apply pressure by means of the copper upper electrode.

The steel heading set comes down on the rivet in a line parallel with its axis. There is no vibration in the machine, as the blow is not repeated and consists chiefly of the application of a steady pressure. The operation is noiseless; it consists principally of bringing the rivet to a cherry red, and then forming the head immediately. Setting the rivets while hot requires a pressure only one-eighth as large as when done cold. Furthermore, the crystallization of the metal that is apt to occur in cold setting does not take place. The riveting can thus be performed as quickly, and, it is stated, more quickly in some cases than cold riveting can be done.

To operate the machine, the operator places the work with the rivet already assembled in it on the horn of the anvil, and then depresses the pedal. This action causes the copper electrode to descend and make contact with the upper end of the rivet. Further movement of the pedal closes the electric circuit by means of the contact that can be seen on the right of the head.

As soon as the rivet has reached a glowing red, as in Fig. 2, the foot pedal is released. The first action due to this movement occurs in breaking the circuit by means of the spring in the switch mechanism just referred to. It should be noted that this switch is merely a master or controlling switch, and does not itself break the current for the electrode, as this break is made in the primary circuit. The electrode itself then breaks contact with the work. The advantage of this arrangement is that the electrode does not make nor break contact with the work while the current is on, so that no sparking occurs.

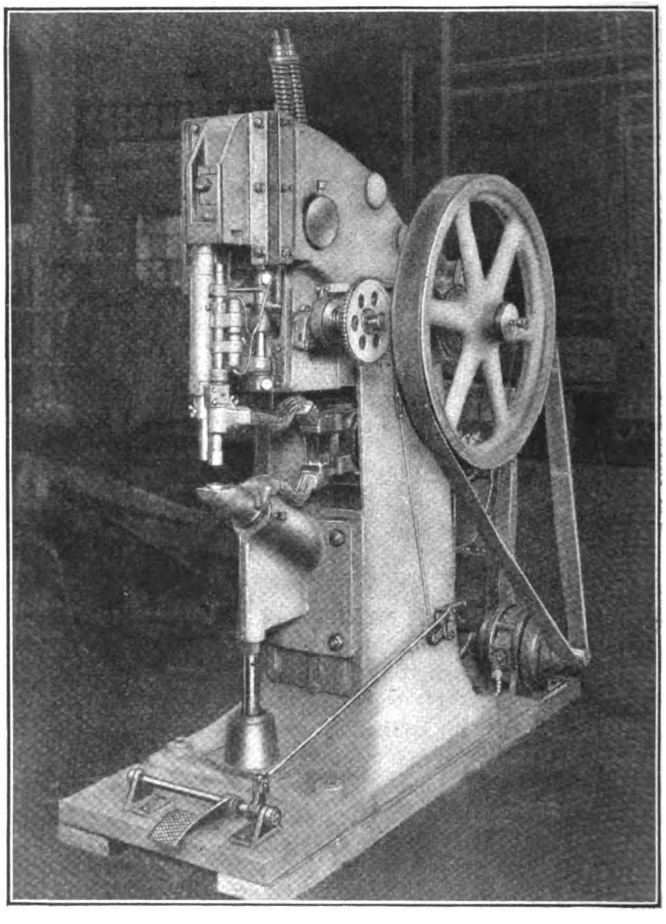


FIG. 1—KOBERT TYPE-NB DUAL-HEAD ELECTRIC RIVETING MACHINE

When the electrode completes its up-stroke, the clutch in the drive is automatically tripped, thus operating a

cam on the left side of the machine and throwing the heading set into a line directly over the rivet. The head immediately descends, forms the rivet head, and returns to its upward position on the left.

The operation is very rapid, and the average time for heating a $\frac{3}{8}$-in. rivet is stated to be approximately 3 sec. It should be noted that the operation is largely automatic, as the only function of the operator, aside from seeing that the work is properly located, is to press on the pedal. The pressure required is only 1 lb., a feature that should tend greatly to eliminate fatigue.

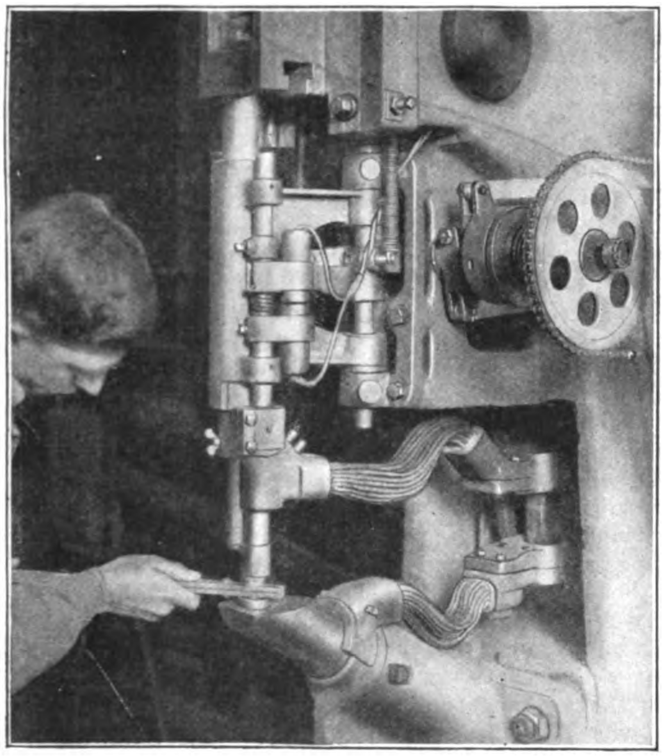


FIG. 2—HEATING RIVET IN KOBERT MACHINE

The machine is driven at constant speed, either from a lineshaft or from an individaul motor. By means of the clutch previously mentioned, the power mechanism can be engaged so as to cause the descent of the riveting head. This drive mechanism incorporates a feature worthy of note. By means of this feature both the maximum pressure exerted can be controlled, and a safety device is provided so that nothing in the mechanism will be injured even though the descent of the riveting set is blocked. The drive from the crank on the drive shaft to the ram takes place through a "walking beam" that is so fitted with a spring-loaded toggle mechanism that the ram can be held while the crank turns, without breakage of any parts. The release mechanism does not come into play until the pressure under the heading set exceeds the maximum for which the mechanism has been adjusted.

The advantage of this construction is that the ram is usually so set that when the crank is about 80 per cent through its possible stroke, the rivet is home. Throughout the rest of the travel of the crank the ram dwells on the work so as to press the parts securely together. Should an additional thickness be placed between the riveting points, a longer rivet may be interposed and driven home, because the machine automatically compensates for the additional thickness.

The current necessary to operate the heating element is naturally of the alternating type. It is transformed to a voltage from 4 to 6 to pass through the electrodes. Control or switch panels separate from the machine, such as in Fig. 1, control the amount of current that is employed for different diameters of rivets. The cost of energy for heating is small, since 1,000 $\frac{1}{4}$-in. rivets are stated to consume not more than $1\frac{1}{2}$ kw.-hr.

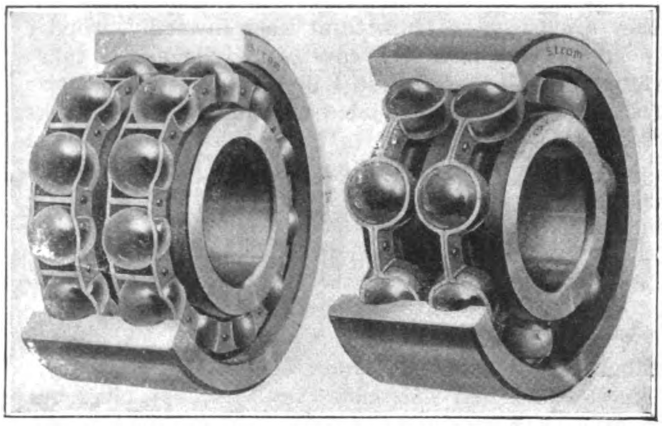
Pre-assembling is advocated in practically all cases, to facilitate rapid operation. Ordinarily, the work requires only one operator or an operator and one assembler. Special fixtures can be developed for parts made in very large quantities and for operations having special requirements. In some cases the machine can be made horizontal. For work such as on roller chains where the pin itself has been heat-treated and must not be heated in the riveting, the current is not passed through the entire rivet, but the ends of two pins are heated simultaneously, with the current passing through the link.

The Type-NB machine which is illustrated is intended for use on rivets from $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter. The machine has a 10-kw. transformer, and is ordinarily driven by a 2-hp. motor. The throat depth is 18 in. The machine is 76 in. high and requires a floor space of 39 x 28 in. It weighs 4,000 pounds.

The Type-NC machine is similar in principle, but is intended for rivets from $\frac{1}{2}$ to $\frac{3}{4}$ in. in diameter. Due to the fact that it is back-geared with a ratio of 6 to 1, a higher flywheel speed is employed. The transformer has a capacity of 15 kw., and 3-hp. are required to drive the machine. The throat depth is 24 in. The height of the machine is $83\frac{3}{4}$ in., while a floor space of 49 x 36 in. is required. The weight of the large machine is 5,800 pounds.

Strom Double-Row Radial Ball Bearings

Double-row ball bearings for radial load have recently been added by the U. S. Ball Bearing Manufacturing Co., 4535 Palmer St., Chicago, Ill., to the line of single-row radial, angular contact and thrust ball bearings made by the concern. Two types of bearing are furnished, the standard and the maximum. The standard bearing is shown at the right of the accompanying illustration, while the bearing for maximum service, which contains more balls than the standard type, is shown at the left.



STROM DOUBLE-ROW BALL BEARINGS OF STANDARD AND MAXIMUM TYPES

One of the principal features of the bearing is the construction of the retainers. Independent riveted re-

tainers are employed for each row of balls, so that the same strength is obtained in each retainer as in the single-row type of bearing.

The bearings are stated to be especially adaptable for installations requiring large bearing capacity in a limited mount of space. Although intended primarily for carrying heavy radial loads, a thrust load of 25 per cent of the maximum radial load can also be withstood. The maximum type bearings have capacities 25 per cent greater than the standard type. The bearings are made in a range of sizes from 10 to 110 mm. bore (0.394 to 4.330 in.).

How to Secure Co-operation

By Entropy

In all my rambles about the shops of the east in the past 30 years I have never seen what could be called complete co-operation in any organization. Some of the poorest examples were in places where the manager thought he had it, but where as soon as the veneer was broken through and the real state of the shop was seen, there was no co-operation at all, only the eye service which so often lulls the head of a plant. In other cases there was nearly complete co-operation within the shop but mostly in opposition to the management.

The nearest to good co-operation seems to lie in places where the plant is not too large for one man to dominate and where the one man painstakingly selects and trains his subordinates into a sort of hero worship of himself. This kind of co-operation does not always lead to the greatest profit. Perhaps the most profitable organization is one wherein each superintendent or department head is capable of carrying on his own work without supervision and where the different departments are so distinct that only a little co-operation is necessary. One way to secure the object is not to ask for too much of it.

It is very often necessary, however, to assign to someone duties and responsibilities which might equally well be given to any one of two or three parts of the organization. In that case whoever does not get them, if they are prized, is sure to at least inwardly, wonder why he did not have the coveted privilege. It takes a rather strong man to sit still and see someone else make a "mess" of a good job, especially when he thinks that he himself would have been able to make it a success. Such men, according to their size, are likely to say, "Well, let's see how soon the other chap will hang himself with his own rope." And even if the other chap does not hang himself, they are not likely to become more reconciled to the arrangement as time goes on.

A shop of over five hundred men cannot usually be dominated by one man. There are exceptions, but it is very seldom that one man can remember all about even five hundred workmen and foremen, and unless there is remembrance there is not acquaintance, and if there is not acquaintance there is not much co-operation. Strangers do not co-operate except under pressure of necessity. Intimate acquaintanceship and respect seem to be the essentials to co-operation. Respect may be due to intellect or to sentiment or even to emotion, that is, "the old man" may be so capable that everyone feels willing and safe in trusting to him for guidance. No one may think of thinking for himself. Such a form of co-operation is unsafe, for when the one man wants to retire or death does retire him, there is a void that is not usually filled at once. The second, sentiment, is often given to the son of the intellectual giant of the first instance. Often it is misplaced but it certainly gives the second generation a chance worth taking to assume the reins of leadership. The third is not so often seen in business as in politics where men often are elected and re-elected for purely sentimental reasons and not because they make the best officers. In the shop we see the same thing in the retention of loyalty to old men long after they have been retired from active participation in the business. That kind of loyalty and its attendant co-operation are just as valuable to the firm that can command them as is either of the others.

Of course the ideal situation would be to combine the three. The head of the firm should be of that highly intellectual type that is always right and yet does spectacular things with ease. He should command co-operation through some sentimental thing even if only because he married the daughter of the founder of the firm, and he should appeal to their emotions if only by an appearance of that austere dignity softened by an occasional unbending at the death of some old workman or similar event that makes the workmen respect his emotions. The combination is so rare as to be almost unknown, but the nearer a leader comes to this ideal the stronger and more vital the co-operation which he commands.

One thing which does not secure co-operation is for the head of the firm to hive himself up in his office away from his employees. Very few firms have been able to overcome the handicap thus established, and most of those have had some man who though not nominally the head was accepted as such by the subordinates, and who made his personality a direct asset to the firm by getting out around the plant frequently. True, a man may have great intelligence, an intimate knowledge of a business and yet have a personality such that he cannot inspire the confidence of workmen and people in general. If the choice of executives narrows down to such a man, it is absolutely necessary that he work in co-operation with some man who can represent him before his own employees, and who as spokesman for him will supplement his weaknesses.

Credit Must Be Properly Placed

If the majority of employees were naturally co-operative the problem would not exist, but unfortunately too many people have found that they get very little that they do not earn, and they find too many piratically inclined associates who do not hesitate to appropriate to themselves the credit for improvements made by others if the opportunity offers. After seeing some one else carrying off credit for his inventions and suggestions almost anyone is likely to make sure that nothing of the kind happens again. Consequently many shops hardly get a helpful constructive suggestion from their employees from one year's end to another. A suggestion box does no good. The only thing that can help is the confidence that the men at the head of the organization will insist that every superintendent and every foreman give credit where credit is due and not elsewhere. In other words, the manager who secures co-operation must make sure that his personality, and his good character, and reputation for fair play are transmitted to and through every minor executive in the plant.

News Section

American Machinist Editors Meet in Annual Conference

The *American Machinist* editorial staff got together for its annual conferences on plans for the new year on Dec. 18, 19 and 20. Ethan Viall came in from Cincinnati, Howard Campbell from Chicago and Ellsworth Sheldon from New England to talk over with the New York men the features to be included in the two coming volumes of the *American Machinist* and various other editorial problems.

On Monday evening the staff had dinner together at Brown's Chop House and went on to the theatre afterwards. Tuesday noon they had lunch at the Engineer's Club with Mr. McGraw and vice-presidents Mehren and Britton as their guests. At the luncheon Mr. Britton outlined the circulation problems affecting the industrial unit and particularly the *American Machinist*. Mr. Mehren described the new unit system under which the company is now organized and explained the reasons for its adoption and its method of functioning. Mr. McGraw wound up the gathering with an inspirational talk on editorial duties and opportunities.

The conference was decidedly successful and plans for adding a semi-annual conference at which the advertising solicitors and the field superintendents would also be present are under consideration.

Welding Society Holds Monthly Meeting

The Metropolitan Section of the American Welding Society held its regular monthly meeting in the Engineering Societies Building, 29 West 39th St., New York City.

The meeting was well attended and much interest was shown in the two excellent papers presented to the members. A. S. Kinsey, professor of Shop Practice, Stevens Institute of Technology and advisory service engineer for the Air Reduction Sales Co., read a paper entitled, "Applications of Cast Iron Cutting by the Oxy-Acetylene Torch," and E. S. Eldridge, welding foreman, Kingsland Shops, D. L. & W. R.R., talked on "Practical Welding."

S.A.E. Annual Meeting Is Announced

The annual meeting of the Society of Automotive Engineers, according to an advance announcement made last week, will be held in New York City, at the Engineering Societies Building, 29 West 39th St., Jan. 9 to 12, 1923.

The National Automobile Show will be held concurrently at the Grand Central Palace from Jan. 6 to 13. Through the courtesy of the National Automobile Chamber of Commerce tickets will be distributed gratis to S.A.E. members attending the annual meeting.

The Automobile Body Builders' Show will be held at the Twelfth Regiment Armory from Jan. 8 to 13. Tickets for this Show have been provided for S.A.E. members attending the Annual Meeting through the cooperation of the Automobile Body Builders Association.

These two shows will include all of the latest developments in passenger-cars, passenger-car bodies, automobile accessories and equipment. Combined with the S.A.E. meetings they represent an unusual educational value to all automotive engineers and executives.

Mason Britton Elected Vice-President of McGraw-Hill Company, Inc.

At a meeting of the executive committee of the McGraw-Hill Co., held on Tuesday, Dec. 19, Mason Britton was elected a vice-president.

Mr. Britton entered the circulation department of the *American Machinist* on Feb. 10, 1901, going from there to be assistant advertising make-up. He was next transferred to the production department which at that time was in a different building. Part of his duties consisted of taking care of some of the production accounts.

The next move was back to the make-up department where he soon became head make-up and handled both the advertising and editorial pages of the *American Machinist*, writing advertising copy to occupy spare moments. He was later sent to the advertising service department and became manager of that department in a short time.

Then came an opening as business manager of the *American Machinist* and Mr. Britton received the appointment, later assuming the title of general manager.

As vice-president of the McGraw-Hill Co., Inc., Mr. Britton is directing head of the industrial unit which consists of *American Machinist*, *Power* and the circulation department of the *Industrial Engineer*. He continues as general manager of the *American Machinist*.

November Exports Establish Year's Record

A new high record for the year in American exports was established during the month of November just passed, according to official overseas trade statistics made public today by Director Klein of the Bureau of Foreign and Domestic Commerce of the Department of Commerce.

Returns from Customs Districts all over the United States received in the Department of Commerce show that American agriculture and industry benefited from export business totaling $383,000,000 during November. This sum is about $90,000,000 higher than the value of shipments during November, 1921. It is $12,000,000 greater than October, which was the best previous month for the present year.

Engineers Plan Reception to Italy's Envoy

American engineers are planning a big reception to Prince Gelasio Gaetani, Italian Ambassador to Washington, now on his way to this country. A dinner, at which engineers from all parts of the country will be present, will be given in honor of the new diplomat, himself an engineer, by the American Engineering Council of the Federated American Engineering Societies, in Washington, on the evening of January 12, it is announced by L. W. Wallace, executive secretary of the federation.

The dinner will be the concluding event of the two-day annual meeting of the council, which will consider problems of national interest, including the report of the committee on work periods in continuous industries, which has reported in favor of the eight-hour day.

New England Engineers Hold Meetings

Engineering and technical associations in Western New England are enjoying a season of activity. At a joint meeting of the Engineering Society of Western Massachusetts and the Western Massachusetts section of the A.S. M.E., in Springfield, Mass., Dec. 19. Calvin W. Rice, national secretary, gave an account of the work of engineering societies in South America and the part they play in developing that continent.

H. H. Dewey of the General Electric Co., Schenectady, N. Y., addressed the Springfield section of the A. I. of E. E., Dec. 15, on "Recent Developments in the Design of Transmission Systems," dealing especially with problems of long-distance transmission in the desert and mountain regions of the West.

At a meeting of the Springfield Employment Managers' Association, Dec. 14, C. M. Ripley of Schenectady gave an account of the corporate organization and distribution of income of the General Electric Co., with a discussion of factors entering into efficient public utility service.

At a meeting of the Springfield chapter of the American Society for Steel Treating Ernest E. Thum, associate editor of Chemical and Metallurgical Engineering, addressed the members on educational policies relative to the laying of a ground work for a technical career.

A Bullard Bond Issue

The Bullard Machine Tool Co., Bridgeport, Conn., has issued $1,500,000 in 6½ per cent first mortgage bonds through S. W. Straus & Co. These bonds constitute a closed first mortgage on the land, building and equipment owned and to be acquired. These are coupon bonds, payable June 15 and December 15, maturing in from two to fifteen years.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

By THEODORE H. PRICE
Director, *Commerce and Finance*, New York

IF UNIVERSAL recognition of its financial strength and economic predominance can make a nation happy then indeed this ought to be a happy Christmas for the people of the United States.

The world today waits upon America's decision with regard to the German loan, and the tone and tendency of the markets reflect the belief of the moment in the success or failure of the negotiations. Authentic interviews with Mr. Morgan and his partners make it clear that no loan can be placed here until France has agreed to reparations that are within Germany's ability to pay.

The French have not yet shown any willingness to abate their claims, but there is nevertheless an underlying feeling of confidence that the compulsion of events will somehow bring about an arrangement that will make it possible for Germany to borrow. The fact that enormous profits might be made directly and indirectly by those who had to do with the transaction has helped to strengthen the belief in its ultimate and early consummation. To this belief the steadiness and upward tendency of the markets last week was due and from now on the prospects of a loan will be a major influence upon sentiment here and abroad.

It is obviously impossible to speak with certainty as to the outcome, but if one had to make a guess it would seem wisest to assume that a credit so necessary would somehow be provided. As to the assertions of some that if such a credit is granted it will never be repaid it may be answered that the three greatest commercial nations, England, the United States and Germany, have more than doubled their aggregate population and quintupled their national income in the last fifty years, and that he who would measure the world's earning power in 1972 by present standards is a poor student of history.

Of the effect that the proposed loan would have upon American business it is possible to speak more definitely. There is hardly a doubt that it would work an instant increase in the export demand for our surplus production and a revival of industrial and commercial activity all over the world.

Our present national income is estimated at 65 billion dollars annually. If the effect of the loan should be to increase it by only 10 per cent, a minimum estimate, we should have recovered within a year four times the billion and a half that Germany seeks to borrow, and could well afford to charge our share to profit and loss.

In this larger view the economic logic of the loan seems to justify the assumption that it will be arranged. If not it is to be feared that Germany will be plunged into a condition of economic chaos from which she will emerge only through political revolution.

Encouraged perhaps by the hope that Europe will soon be put on an even keel the tone of domestic business has become a little more optimistic. The failure of a well known firm of stockbrokers in Kansas City had only a passing effect. On the Stock Exchange quotations are higher and the new bond issues offered have been readily absorbed. The rush to declare stock dividends continues but the tax selling is about completed and the recipients of the newly issued shares seem willing to keep them for the present. The Great Northern Railroad has reduced its dividend to a 5 per cent basis, but this reduction has been offset by an increase in the Michigan Central rate.

The car loadings are the largest on record but the congestion of traffic is unrelieved and business suffers accordingly.

The anomaly of the railroad situation is emphasized by an application from the Receivers of the Chicago, Peoria & St. Louis R. R. for permission to abandon that line in its entirety because it cannot earn enough to pay taxes. The road is 237 miles in length and serves a considerable population. If it had been part of a large system it might have been made to pay and the announcement that the Cleveland syndicate headed by the Van Sweringens has added the Chesapeake & Ohio to its recently formed trunk line system shows that the necessity of consolidation as a condition of survival is becoming more widely recognized.

An increase of 6 per cent in wages has been allowed to the 50,000 members of the Iron Moulders Union and other increases in other trades are expected shortly. Reports from the iron and steel industry are optimistic, with the mills running at 85 per cent of capacity.

The creation of another important unit in the steel industry has been effected through the purchase of the Brier Hill Steel Co. by the Youngstown Sheet and Tube Co. The formation of the Columbia Steel Corporation is also reported from San Francisco. It is a consolidation of the Columbia Steel Co. and the Utah Coal and Coke Co.

At 14$\frac{3}{4}$ cents copper is at last well on its way upward. The advance is attributed to the reported but unconfirmed purchase of one large producing concern by another. There is, however, good reason to credit the report, for the spirit of consolidation seems to be in the air and the deal by which the Armour Company is to take over Morris & Co. is said to have been consummated with the Government's tacit approval.

Cotton, wheat, corn, rubber, sugar and coffee have all been steady with an upward tendency due to the hope that the German loan will be arranged, but restrained by Mr. Morgan's disavowal of any agreement to which his firm was a party.

The weekly statement of the Federal Reserve System shows a decrease of $15,000,000 in gold and an increase of $74,000,000 in circulation, both probably due to the holiday demand for gold and pocket money. As a result the reserve ratio has fallen to 72.8 per cent as against 75.1 last week. It ought to rise again in January. If not, higher rates for money would be natural, but thus far there has been no change and the best commercial paper can still be sold at 4$\frac{1}{2}$ per cent.

General trade is good but not abnormally active. The Christmas shopping which was begun early is now finished and the business world awaits the commencement of the New Year with confidence but without the expectation of a boom.

In its annual report the Bank of Montreal is optimistic as to conditions in Canada and a definite improvement in Cuba is expected when the $50,000,000 loan that is being arranged for shall have been placed.

Our exports for the month of November were valued at $383,000,000, which is larger than for any previous month this year. This is both surprising and encouraging but how we have been or will be paid for these exports is still a mystery.

Further Progress in Production

Continued advances in production, transportation and distribution in November are noted in figures compiled by the Department of Commerce in its "Survey of Current Business." The largest consumption of cotton since 1917, and further high records since 1920 in the output of pig iron, steel ingots, zinc, coke, locomotives, and upper leather emphasize the sustained and basic character of industrial production in November. The usual seasonal decline in building contracts in November failed to materialize.

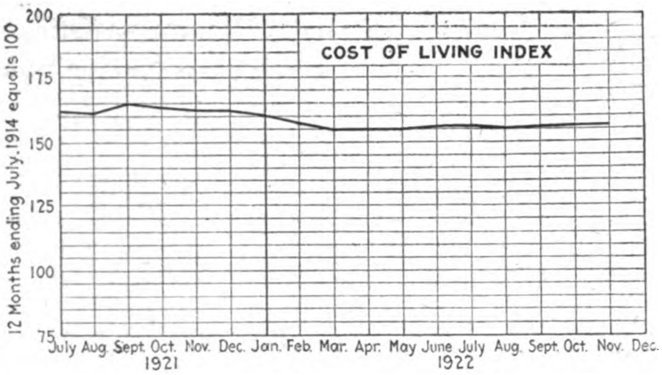
The car shortage on the railroads was slightly relieved, but coal cars were still in great demand and coal loadings have been kept up to the maximum; total loadings of all classes were very high for November. Increased orders were made for locomotives and freight cars to overcome present congestion.

Price levels continued to increase in November, with both the total wholesale and the retail food indices the highest since the end of 1921. The relative purchasing power of farm products was considerably improved in November and this is reflected in the largest mail-order house sales since March, 1920.

The final crop reports for the year 1922 indicate a large production of the principal crops, especially wheat, potatoes, corn and rye, and should make for increased prosperity in the farming sections.

Unfilled orders of U. S. Steel Corporation based on the monthly reports showing the forward tonnage on the books at the end of each month.

Index of the Cost of Living based on weighted retail prices collected monthly and compiled by the National Industrial Conference Board.



UNFILLED ORDERS on the books of the U. S. Steel Corporation on Nov. 30, 1922, totaled 6,840,242 tons as compared with 6,902,287 tons on Nov. 31. The tonnage on order at the close of November, although 62,045 tons below the month previous, is greater than for any month since February, 1921, at which time unfilled orders totaled 6,933,867 tons. Beginning with March of the currrent year, an increase has been shown in each thirty-day period ranging from 140,630 tons in July to as high as 741,502 tons during September. Railroad requirements and building construction demands continue as the chief features of the increase.

Metal product shares in the New York stock market declined during November, the average price of ten representative issues dropping to $77.50 per share as against $79.50 in the month previous. The decline is without special significance, the entire market having receded from the high point reached during September due chiefly to a lack of general public interest. The electrical equipment companies report a large volume of business on order.

Railroad rolling stock continued to attract attention during November, chiefly on account of the car shortage which began to be acute in October. With 179,239 cars short of requirements on American roads on Oct. 31, the increase has continued, although not so acutely, the shortage on Dec. 1, standing at 143,279 cars. The average for the month was 150,787 cars as against the October average of approximately 160,000 cars. Car surplusage changed slightly, the average being 5,735 as against 4,475 in the month previous. Cars in bad order decreased from 249,960 or 11 per cent to 225,842 or 10.1 per cent. Loadings of coal and grain continue heavy.

Comparative Prices of Shop Supplies

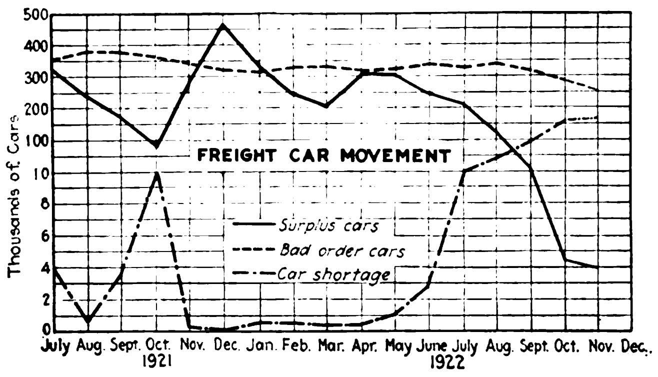
Average of New York, Chicago and Cleveland Prices

	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars..	per lb....	$0.0295	$0.0295	$0.0273
Cold finished shafting.....	per lb....	0.0378	0.0378	0.0373
Brass rods......	per lb....	0.171	0.1700	0.15
Solder (½ and ½)	per lb....	0.24	0.23	0.20
Cotton waste...	per lb....	0.11	0.11	0.122
Washers, cast iron (½ in.)...	per 100 lb.	4.33	4.33	4.33
Emery, disks, cloth, No. 1, 6 in. dia.......	per 100....	3.11	3.11	......
Lard cutting oil	per gal....	0.59	0.575	......
Machine oil....	per gal....	0.36	0.36	......
Belting, leather, medium.....	off list....	30-10% @50%	40-5% @50%	
Machine bolts up to 1 x 30 in.	off list....	55% @60%	50%@ 65-10%	50%@ 60-10%

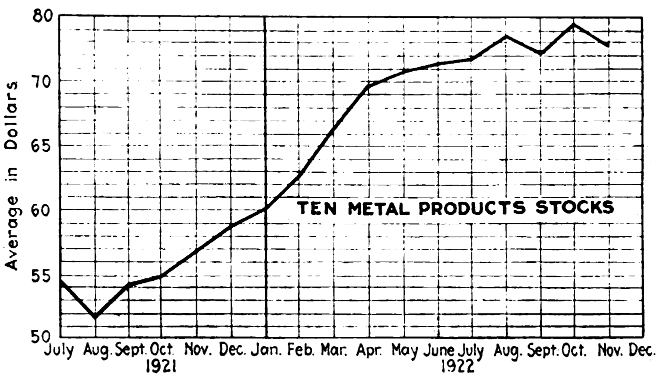
Cost of living among the families of wage earners in the United States on Nov. 15, was 58.4 per cent higher than in July, 1914, according to figures collected by the National Industrial Conference Board. Between Oct. 15 and Nov. 15 there was an increase of 1.3 points or one per cent. The changes in the budget within the month were continued slight increases in the average cost of food, clothing and coal. Between July, 1920, when the peak of the rise in the cost of living since 1914 was reached, and Nov., 1922, the cost of living dropped 46.1 points or 22.5 per cent.

American foreign trade for November shows a gain in exports of more than $12,000,000 over the previous month, October shipments in turn being $57,000,000 greater than in September. The increase in November, as in the case of October, is due chiefly to raw cotton shipments, exports of this commodity alone being valued at more than $109,000,000, out of a total of $383,000,000. The November total shows an increase over the corresponding month of 1921 of approximately $90,000,000. Import figures are still unknown owing to the changes in the new tariff rates.

Monthly average of car shortage surplus and bad order cars in the United States based on returns to the car service division of the American Railway Association.



Monthly average: Ad. Rumely; Allis-Chalmers; American Can; Cont. Can; Gen. Elec.; Int. Harv.; Nat. Acme; Und. Type.; West. Elec. & Mfg. Co.; Worth. Pump.



The South African Machinery Market

Vast Territory of Great Richness—Offers Big Opportunity to Machinery Builders—Backward Native Showing Marked Progress

BY A LONDON CORRESPONDENT

AMERICAN manufacturers of electric equipment will be repaid by catering to the South African trade, because there is every indication that it is becoming one of the most important markets for these products. In 1921, overseas purchases amounted in value to approximately £2 millions against 1½ millions in 1920 and £1 million in 1913. During the past year there have been numerous installations of lighting plants in towns and villages, while the growing demand for power has compelled the local authorities at Cape town, Durban, Johannesburg, Pretoria, and other large centres to extend existing generating stations and to provide additional facilities. In spite of the general trade slump of the last two years the value of the trade has not declined, but has steadily risen.

There is every indication that this activity will be continued during the coming year. Reports from all the leading business towns point to the fact that stocks of fittings, etc., are very low, while it is generally agreed that orders for considerable amounts will have to be given out as soon as the power plants now on order have been installed. Both German and British firms are carefully watching the needs of the market. As German exporters are failing now to guarantee the date of delivery, while their prices show a tendency towards steady expansion, the principal rivalry will come from British firms. Other things being equal the feeling in South Africa is to place orders for electric plants with British houses, but there is a decided tendency on the part of the exceedingly important business in fittings, lamps, cooking and heating apparatus and general accessories to pass into the hands of foreign competitors. Tenders for the supply of generating plant are invariably advertised in the press in the usual way, but it is the local merchants who supply fittings, and it is very important, if business is to be obtained, that these dealers should be carefully canvassed both personally and by catalogs, together with the latest data respecting new lines and operations. Buyers in South Africa are particularly keen on new electrical devices and it will repay manufacturers to study them.

Strong European Competition

The latest information from this market is to the effect that the United States exporters of electric iron supplies have almost lost the trade in consequence of the cheap lines introduced from Germany and to a lesser extent from the United Kingdom. Formerly American makers had a monoply in this direction. Whether German exporters can continue to supply these goods at such cheap rates is open to question, because her manufacturers are coming to the end of their tether, but even then British firms can underquote American prices. The average retail prices of a 5 lb. electric iron of American, British and German manufacture are, respectively, $9.50, £1 15s., and $7. Dealers in electric supplies report that more German irons are sold than of all others together, and that both wholesale and retail traders make a large profit on them. The agents of American firms in South Africa say that unless their home manufacturers can so pricee their irons that a retailer can sell a 5 lb. model for $8 or less the market may be entirely lost to American exporters.

Importance of Native Trade

The importance of the native trade in South Africa is generally overlooked by exporters. In South Africa and Rhodesia alone there are six million natives, as compared with a little more than 1½ million Europeans. The purchasing power of the native, present and future, is enormous. He is advancing in the scale of civilization, and his necessities are multiplying accordingly. The modern requirements of domestic life are every day more revealed. The plow and harrow are steadily superseding the pick and hoe and there is a good demand for the simpler kind of farm implements. The native population is increasing to a far greater extent, relatively, than the white population, and it can readily be imagined what the trade position will be in the near future. It should also be remembered that the total native population from the Cape to the Equator is estimated at over 40 millions.

It is very satisfactory to be able to record that the trade in agricultural implements throughout the South African Union is reviving. While many of the simpler types of implements have long been adopted on South African farms, there is wide scope for the sale of tools and machines embodying later improvements. Maize planters and one-horse cultivators, gang plows, lever harrows, mowers, rakes and maize shellers are among the implements in fairly general use; but on the other hand, adequate advertisement and demonstration should lead to the introduction of more up-to-date apparatus for planting and cultivating, including grain drills, disk harrows, ensilage cutters and many others. The type of plow in most common use is the two furrow walking mould-board, but the disk plows are also popular, especially in Rhodesia. There is considerable competition in this market for the supply of implements and agricultural machinery.

During the past ten years the disk harrow has been gradually superseding the tooth harrow. It was first introduced into the Transvaal and Natal, and there is believed to be a good opening for extending its sale in the Orange Free State and throughout the western parts of the Cape. The disk harrow is used in the cultivation of alfalfa, a very popular crop in South Africa, and it is credibly reported that a ready sale exists for other implements which are needed in connection with this crop.

As regards threshers, the demand is governed by the fact that this work is generally executed by contractors who travel from farm to farm, or in centers to which the small farmers cart their crops. Sometimes there is a sale for medium size threshers with 24 and 30 inch cylinders and straw chopper and bruiser attachments. There is also a demand for hand and power stationary threshers with 14 and 18 inch cylinders. In Rhodesia ground nut and sunflower seed threshers are also needed. There will probably be a larger demand for binders as more land is gradually bought under wheat cultivation.

The following table gives the value of the leading imports of machinery and implements into South Africa in 1921:

Kaffir hoes and picks	£28,578
Dairy utensils	57,114
Hay presses	7,810
Plows, harrows, and parts	439,093
Reaping and mowing machines	55,867
Tractors	45,897
Wine presses and pumps	2,036
Other implements and machinery	363,810

One of the best and most practical ways of pushing trade in this market is to exhibit freely at the best local farm shows. Districts affected by drought are good buyers of windmills, pumps, and piping.

Tractor Prospects Bright

With the return of better times the South African farmer will be a better purchaser of tractors. Among the points to be considered in this connection are the following: types of tractors suitable for certain soils, horse power relative to the altitude at which the tractor is employed, method of distribution, spare parts and "service." In Zululand plowing is made difficult by the roots of sugar cane remaining in the ground, and also by the lack of moisture. The soil in Natal and the Cape is fairly light and easy to work. On the other hand, the soil in the Transvaal and the Orange Free State becomes intensely hard and dry. As regards the internal combustion engine it should be stated that the loss of power at an altitude of 4,000 feet amounts to 10 per cent, and at 5,000 feet the loss is reckoned to be 20 per cent. These elevations are often met with throughout the country. Along the coast of Natal and in the Cape Province, power is slightly increased in consequence of the humidity of the air.

There is today an excellent opening throughout Rhodesia, for small mine plant as distinct from the large battery stamps, etc., purchased by the big companies. The market for mining machinery is at present worth about £60,000 a year, but when we remember the various mining developments now taking place, the value within the next five years might very well be trebled.

There are innumerable opportunities

in this market for the sale of electrical, industrial, mining, farming and other machinery. Rhodesia is one of the few countries that has emerged almost unaffected from the general commercial depression of 1921. Indeed, more manufactured goods were imported during that year than in the boom year of 1920.

Even quite small towns are actively considering the possibility of erecting power stations. Taken separately, these may be only small orders, but if viewed collectively they amount to a very respectable sum and become a source of business which no manufacturer can afford to despise. This specially applies to the suppliers of generating plant, electric cable and electric fittings. It is worth noting, also, that Rhodesia's trade in electrical machinery and material has risen in value from £44,000 in 1913 to £88,000 in 1921.

Round about the principal towns, such as Salisbury, there are springing up numerous factories for the production of furniture, soap, candles, metal goods, and many other articles. All this necessarily means a market for machinery and plant of various kinds. It is essential that catalogues should contain full data respecting the working of the machinery dealt with, the assembling of parts; capable local agents are necessary, while a high degree of standardization is necessary in most lines of farm implements. The market for cheap and light plows alone is worth £70,000 a year in Rhodesia.

The principal competition will come from British manufacturers. Until 1921 the Germans were almost a negligible quantity, the value of German imports into South Africa in that year amounting in value to only a trifle over £1,000,000. In the first six months of 1922 they amounted to £1,315,596 and there is every reason to believe that by the end of the year this latter amount will have doubled. These figures are very significant when we examine the general trend of South African trade. Compared with the first six months of 1921 the country's total imports decreased from £29,500,000 to £23,000,000; the imports from Great Britain declined from nearly £16,000,000 to nearly £13,000,000, and those from U. S. A. dropped from £5,500,000 to a little over £2,500,000. Yet the imports from Germany actually rose from £504,000 in the first half of 1921 to £1,315,596 in the corresponding period of 1922. German competition is especially severe in cutlery, enamelled ware, fencing wire, certain classes of machinery, farm implements, tools, etc.

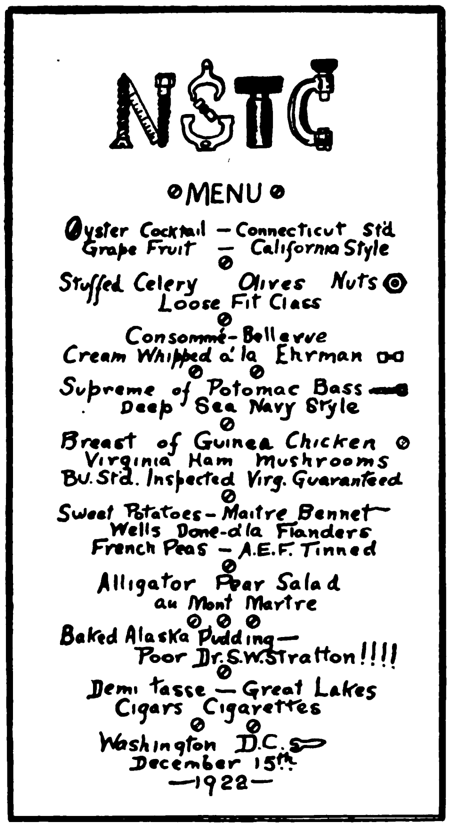
Railroad Rapidly Reducing Bad Order Engines

From Nov. 15 to Dec. 1, the railroads repaired and turned out of their shops 13,484 locomotives. This was within six locomotives of the greatest number repaired during any semimonthly period in approximately the last two years, according to reports received today from the carriers by the Car Service Division of the American Railway Association. This also exceeded by 1,345 the number turned out of the shops during the first half of November this year.

Locomotives in need of repair on Dec. 1 last totaled 18,009 or 27.9 per cent of the number on line.

Screw Thread Commission Honors Stratton at Important Session

That the work of the National Screw Thread Commission is well advanced and is reaching the point where important recommendations will be made public, was revealed at a meeting of the Commission held in Washington on Dec. 15. Since this is the last meeting of the Commission at which Dr. S. W. Stratton, its chairman, will preside, the other members of the Commission gave a dinner in his honor. The menu, reproduced herewith, was decorated cleverly


NSTC
MENU
Oyster Cocktail — Connecticut Std
Grape Fruit — California Style
Stuffed Celery Olives Nuts
Loose Fit Class
Consommé-Bellevue
Cream Whipped a'la Ehrman
Supreme of Potomac Bass
Deep Sea Navy Style
Breast of Guinea Chicken
Virginia Ham Mushrooms
BU. Std. Inspected Virg. Guaranteed
Sweet Potatoes - Maitre Bennet
Wells Done-a'la Flanders
French Peas — A.E.F. Tinned
Alligator Pear Salad
au Mont Martre
Baked Alaska Pudding—
Poor Dr. S.W. Stratton!!!!
Demi tasse — Great Lakes
Cigars Cigarettes
Washington D.C.
December 15th
—1922—

with bolts, nuts, screws, gauges, and wrenches.

Col. E. C. Peck, of the Cleveland Twist Drill Co., was elected to serve as acting chairman of the Commission until a successor to Dr. Stratton will have qualified. The law creating the National Screw Thread Commission provides that the Director of the Bureau of Standards is to be chairman of the Commission. It happened that Col. Peck himself could not be present at this meeting because of the fact that he had to attend the annual dinner given by his company in Cleveland. All other members of the Commission were present.

The Commission is about ready to submit a list of recommended sizes for tap drills. These sizes were carefully considered by the Commission and a number of criticisms and suggestions offered.

F. O. Wells, one of the members of the Commission, submitted a report on recommended sizes and tolerances for bolt heads, nuts and wrenches. The tables of these dimensions were arrived at at a joint meeting of subcommittee number two of the American Engineering Standards Committee sectional commissions. The dimensions cover regular hexagon and square-head nuts for both coarse and fine threads; hexagon head, cap screws, square-head cap screws and wrench openings. Tolerances are recommended for both bolt-heads, nuts and wrench openings.

A sub-committee headed by Major J. O. Johnson is doing preliminary work looking to the standardization of oil-well equipment, especially casing pipe and threaded joints. Major Johnson's committee will work in co-operation with the Standards Committee appointed by the American Petroleum Institute. A report is about completed on special threads for electric fixtures and fittings. This report is based on report No. 1,525 of the American Society of Mechanical Engineers, which was presented in December, 1915, and on a report made on Nov. 19, 1921 by the National Council of Electric Fixture Manufacturers. These reports are being co-ordinated and the screw thread commission is supplementing them in certain particulars. As soon as the report is completed it will be sent out to those interested for suggestions.

The Commission voted to renumber classes of fit so that the fits will be as follows:

NEW

Class 1	Loose fit
Class 2	Full fit
Class 3	Medium fit
Class 4	Close fit
Class 5	Wrench

PROGRESS REPORT

Class I	Loose fit
Class II-A	Medium regular
Class II-B	Medium special
Class III	Close fit
Class IV	Wrench

It was decided to take advantage of the simpler form of consecutive Arabic numbering rather than the use of Roman figures as had been done in the progress report previously submitted.

National Foreign Trade Council

The Tenth National Foreign Trade Convention of the National Foreign Trade Council will be held in New Orleans on April 25, 26, 27, 1923, according to announcement of O. K. Davis, Secretary of the Council.

"The selection of New Orleans as the Convention city," said Mr. Davis, "is peculiarly fitting in view of the development of the city as a great center of American foreign trading activity. In 1921 New Orleans was the second port of the United States, importing coffee, sisal, burlaps, bananas, crude oil, and sugar; and exporting corn, rice, wheat, cotton, glucose, steel rods not wire, iron pipes, steel plates and sheets, lard, cottonseed cake, meal and oil, mineral oils, tobacco and lumber.

"Of special interest to foreign traders in all parts of the Mississippi Valley has been the development of shipping facilities at the Port of New Orleans, and the consequent increase in steamship services. Since the Third National Foreign Trade Convention was held in New Orleans in 1916, this progress has been particularly marked, and has been accelerated by the increasing proportion of American foreign trade carried on with the West Indies, Central America, Mexico, South America and Asia, much of it passing through gulf ports.

Southern Iron Output Makes Record

Official figures on pig iron production in Alabama, the Southern Metal Trades Association advises, reached 208,934 tons in November, the largest month of the year, the largest in fact since the depression period set in more than two years ago. Production was almost 100 per cent larger than that of November, 1921, which was 108,121 tons. There were 22 stacks active in November, but since then others have been blown in and the end of December will find 25 stacks active, the largest number in almost three years. By mid-1923 it is believed all stacks will be running.

The Association also states that what is driving pig iron prices down in the Southeastern district at this time is largely the European competition, considerable tonnage of pig iron from across the water reaching the United States. Lately large tonnages of European made pig iron have been sold to metal trades consumers in the South at prices less than southern makers are quoting.

With the blowing in of two additional furnaces by the Tennessee Coal, Iron and Railroad Co. before the end of December, this company will have eleven furnaces on the active list, and production will be close to capacity in the Birmingham district again. The Southern Metal Trades Association advises that while exact tonnages are not known as yet there have lately been unusually good sales of pig iron, estimating the tonnage at between 150,000 and 200,000 tons. The nominal price level is $23 still, but many sales are reported to have been made under this base, some as low as $21. The pig iron melt will continue well into 1923 according to present indications on a big scale, with the year probably proving one of the biggest in history.

The Southern Metal Trades Association has announced that reductions in freight rates on pig iron from Alabama and Tennessee producing points to Central Freight Association territory, in the opinion of the Interstate Commerce Commission, would discriminate against producers of pig iron in southern Ohio and St. Louis. In the decision of the Commission, therefore, southern railroads have been ordered to maintain the present rates that are in effect, and to cancel all scheduled granting reductions which were suspended on Sept. 1, at which time they werer to have gone into effect.

Car Shortage Shows Decrease

From December 1 to December 8, there was a decrease of 21,825 in the freight car shortage, according to reports received today by the Car Service Division of the American Railway Association from the railroads of the country. The total shortage on December 8 amounted to 111,961 cars.

Shortage in box cars totaled 56,711, a decrease of 10,757 within the same period, while the shortage in coal cars totaled 37,613 or 5,235 below that on December 1.

Reports also showed a gradual increase in the number of surplus freight cars in good repair scattered throughout the country, the total on December 8 being 6,657, which was a gain in approximately a week of 1,062 cars.

The Oakite Sales Conference

The Sixth Annual Sales Conference of the Oakley Chemical Company, New York, manufacturer of Oakite, from Dec. 18 to 21 inclusive, was attended by all but two of its 66 sales representatives. A very interesting feature was the one minute speeches of the first day when every man told of business conditions in his territory. The significant thing was that, without exception, the men reported better business in all lines reached by them and further, that this was in spite of extreme caution in buying. This evidently means that manufacturers have been warned by the prediction of economists regarding a premature false boom, and have effectually prevented it.

Six selling papers occupied the first afternoon session, these being: Essentials of Successfully Selling our Materials, F. A. Aston; Service an Important Factor in Selling Oakite Products, G. M. Barnes; Meeting Unusual Sales Resistance, D. X. Clarin; Advantages of Systematic Planning and Selling, C. A. Ormsby; Developing a New Territory, P. A. Boeck and Impressions of a First Year Oakite Salesman, H. Kennedy.

These conventions have the unusual method of beginning with a breakfast and keeping the men well together during the day. In this way the men get the most out of the meetings.

Technical Papers on Important Topics Presented

The second and third day's papers were technical: Carpet Cleaning, N. W. Halsey; Locomotive Parts, C. Burgin; Territory Laboratories, F. J. Fayen; Field Service Reports, H. J. Butler; Investigation vs. Taking Things for Granted, O. W. Hoster; and Oil Barrels and Drums, J. F. Ewing. This was followed by a second technical session with the nine papers listed, after which there was a dinner and theatre party. The nine papers were: Washing Artificial Silk, G. W. Miller; Kierboiling Cotton Yarn before Mercerizing, A. W. Quinn; Finishing Cotton Knit Goods, H. M. Upson; Some Peculiar Facts in Cleaning, L. B. Johnson; Packing Plant (hog scalding), C. E. Barber; Packing Plants (chiefly outside of hog scalding), O. A. Fiss; Oakite in Chesse Factories and Condensed Milk Plants, F. J. Wall; Oakite in Paper Mills (felts and vitriol on new felts), L. C. Minor, and Comparison of Work in Institutional and Steam Laundries, M. L. Shorey

The third day covered three more technical papers: Oakite in Steel Mills, H. L. Trembicki; Cleaning Auto Bodies before Painting, E. Lacy; and Spraying Oakite Solutions, V. Frazee, followed by laboratory demonstrations.

A unique feature was the awarding of prizes at the banquet, for the best results in the November sales drive. This drive was fashioned after the wild and wooly west, cowboys and all. The salesmen had cowboy names and belonged to typically named ranches. Each man had a certain quota, based on his opportunity and previous record. A point was called a steer and every man who roped 110 steers or over, won a suitably inscribed fountain pen.

Of the 56 men who were actually in the field during the drive, 38 won prizes at the final "round-up," making a remarkably uniform showing for the "cow punchers."

Railroad Tonnage Shows Gain Over 1921

In the quarter ended with September, according to a summary of freight commodity statistics, made public by the Interstate Commerce Commission last week, tonnage hauled by the big or Class 1 railroads of the country was 5.89 per cent greater than in the corresponding quarter of the preceding year. The tonnage was 467,900,164, compared with 441,880,704 in the same months last year.

The increase took place notwithstanding the quarter was composed of the months in which the railroad shopmen's strike became effective, and embraced the months in which the strike of the coal miners was the most virulent. The loss in coal tonnage was only 2.35 per cent. Coal and agricultural products alone showed smaller tonnages than in the corresponding quarter of last year.

Grinding Association Elects Officers

Theodore A. Meyer recently was elected president of the Central Cylinder Grinding Association in Indianapolis. Other officers are as follows: vice-president, W. W. Adams, Fort Wayne; secretary, J. T. Andrews, Indianapolis; treasurer, George W. Kemp, Muncie; board of directors Val H. Lindenschmidt, Evansville; H. B. Shank, Fort Wayne, and V. J. Thampher, Connersville.

Growing Interest in Export Trade

The increased desire of American firms to enter foreign markets with their wares is reflected by a 400 per cent gain in foreign trade inquiries directed to the Department of Commerce this year, as compared with last, Director Julius. Klein, of the Bureau of Foreign and Domestic Commerce, declares in his annual report.

Describing the fiscal year 1921-22 as "one of the most crucial periods in the history of the nation's foreign trade," Director Klein points to the complete reorganization of his bureau under Secretary Hoover's direction as the prime factor enabling it to help American export interests withstand the "inroads of recovering European competition in the world's markets."

Following out the policy of "better service with less meddling," Director Klein says that the Bureau of Foreign and Domestic Commerce now serves business on a commodity basis through seventeen new divisions which specialize on America's great export products of the factories and farms.

In concluding his report, Dr. Klein states that if the bureau is to carry on and enlarge its work in the manner dictated by the economic situation of the country, its activities should be extended to cover the study and promotion of domestic commerce. Its foreign service should be strengthened by the establishment of offices in new markets. Experts in commodities not yet specifically provided for, such as tobacco, grain and many manufactured specialties, should be added to its present staff to meet the increasing demands of the trades.

Numbering of Steels to Be Developed by A.E.S.C.

A system of designating kinds or qualities of steels by code numbers, each of which would represent a definite specification, will be developed as a result of the decision of a conference of the principal producers and users of steel held at Washington, D. C., December 6, at the call of the American Engineering Standards Committee. The conference recommended that this code be developed under the procedure of the A.E.S.C. and suggested to that organization the appointment of the Society of Automotive Engineers and the American Society for Testing Materials as joint sponsors for the code.

The agreement to go ahead with this project was arrived at after a spirited discussion concerning the necessity for and practicability of a numbering system. Strong opinions in favor of the designation of steels by number were voiced by heavy buying interests, such as the U. S. Navy Department, the Electrical Manufacturers' Council, the Society of Naval Architects and Marine Engineers, the U. S. War Department and the Federal Specifications Board. It was pointed out during this discussion that shipbuilders use every conceivable variety of steel opposition to the inclusion of tool steel was voiced by tool steel makers. As against the claim that the numbering of steel is not desirable so far as tool steel is concerned, it was brought out by a representative of the Navy Department that the Navy now has an accumulation of a million pounds of unidentified tool steel, all of which must be analyzed and tested before it can be used. This condition, it was said, would not exist if the quality of steel were designated by code numbers, representing definite specifications, rather than by the general terms, trade names, or brands now in common use, or—in some cases—by no mark at all.

Purchase on Chemical Analysis Makes Numbering Desirable

The arguments used against the numbering of tool steels, Admiral Cone declared, were identical with the arguments used 25 years ago against the writing of specifications for steel of any kind. As an indication of the feasibility of a uniform system of designating steel, it was asserted that almost 90 per cent of the steel used by the automotive industries is purchased on the basis of chemical analysis.

The conference voted that it is desirable to have a uniform numbering system, based on specifications, for forging steels, casting steels, structural steels including plates, tool steels, and other steels, this decision with the exception of tool steels, being taken without dissent. Whether the basis for such a numbering system should be chemical composition, physical properties, or heat treatment was left to be determined by a Sectional Committee, which is to be approved by the American Engineering Standards Committee. It was also left to the Sectional Committee to decide whether there are any existing systems which can be used as a basis for numbering codes for any or all of the various groups of steels. The question of whether brand names can be accommodated to and associated with a numbering system was brought up, but the consensus of opinion was that this is not practicable.

The conference was opened by a résumé of present American practice in designating steels, by Dr. G. K. Burgess, Chief of the Division of Metallurgy of the U. S. Bureau of Standards, and a résumé of European practice by L. H. Fry, representing the American Society for Testing Materials. Mr. Fry said that Switzerland and Germany have already taken definite steps toward a numbering system. The method proposed in Switzerland provides a system of symbols intended to be universal and definite, and capable of expansion to suit new requirements. In France a method is offered by which steels will be numbered with relation to a definite specification for the type, augmented by a letter indicating the method of manufacture, and a number showing the minimum tensile strength. In Great Britain a numbering system is employed for aircraft steels, and a tendency is appearing to develop symbols for automobile steels. Some limited symbolization is used in Holland also. Mr. Frey's full report based on information obtained from abroad by the A.E.S.C. will be sent upon request to the American Engineering Standards Committee.

Sees Budget System in Danger of Attack

Dangerous attacks on the Budget system were foreseen by John T. Pratt, chairman of the National Budget Committee, in an address before the Four Founder Societies of civil, mining, mechanical and electrical engineers at the Engineering Societies' Building, 29 West 39th Street, Wednesday night, Dec. 13.

Jealousies, he warned, would arise in federal bureaus, and perhaps in the Cabinet, from reductions in estimables, though these reductions were insisted upon by President Harding. Mr. Pratt asserted that the people of this country must be split into two main parties with clear-cut differences of opinion on national issues.

"For the fiscal year 1923-1924 the actual Budget estimates on the convening of Congress this month indicated a very small, or no, deficit," said Mr. Pratt. "All these figures and estimates take into calculation no extraordinary expenditures authorized by Congress, such as the soldiers' bonus, the ship subsidy, or other like bills calling for large expenditures of money.

"The dangerous attacks on the Budget system are likely to come from the very large reduction of some $600,000,000 made by General Lord, at the instance of the President, in the tentative figures of the Departments for 1923-1924, which were that amount larger than the actual figures submitted by the President in his message to Congress. No such cut can be made in the tentative estimates without arousing jealousies and dissatisfaction on the part of many of the bureau chiefs, and possibly some of the Cabinet officers."

The tendency of the times, according to Mr. Pratt, seems to be one of dissatisfaction with national legislation. The people feel, he said, that they are not getting full, complete and immediate action from their representatives in Congress in accordance with their ideas. He added:

"The people seem to be reaching out for a pure democracy, forgetting to realize that there is a very distinct difference between a republic and a pure democracy. The setting up of the Constitution indicates it was the first clear check against the historical development of democracies and established the principle of a republican form of government.

"The Budget Act is another similar check to the tendency to establish a free democracy, instead of the republic form of government, in this country. I refer to the republican or constitutional form of government, as opposed to the tendency shown by the attempts of the La Follette group for extension of the direct primary system and for modifications in the Constitution which would permit of a more immediate expression of popular will by shortening the time between the election of representatives and the convening of Congress."

Mr. Pratt declared that the National Budget Committee would constantly try to create public consciousness in favor of preserving the integrity of the Budget Act of 1921. Other aims, he said, were reorganization on functional lines of the executive department of the government, and co-ordination between the executive and the legislative branches by having Cabinet members appear on the floor of the House and Senate in defense of their Budget estimates.

Further Decline in Structural Steel Sales

A considerable seasonal decline occurred in the sales of fabricated structural steel in November, according to reports received by the Department of Commerce through the Bureau of the Census. November sales amounted to 46.8 per cent of shop capacity as against 57.3 per cent reported for October.

These percentages are based on a uniform capacity rating recently reported to the Bureau of the Census by almost all the reporting fabricators. Through these new ratings, the total monthly capacity of the 140 identical firms reporting each month from April through November has been reduced from 223,685 tons to 211,510 tons. The following table shows the tonnage booked each month by these firms and the percentage of their revised capacity:

	Tonnage Booked	Per Cent of Capacity
April	193,520	91.5
May	173,588	82.1
June	154,770	73.2
July	143,907	68.0
August	146,621	69.3
September	137,485	65.0
October	121,150	57.3
November	99,049	46.8

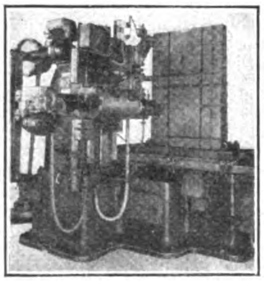
On the basis of these revised capacity reports and of known or reliably estimated capacities of other concerns, the Department of Commerce places the present capacity of the fabricated structural steel shops at 250,000 tons per month.

A considerable increase in the capacity of the structural steel fabricating shops of the United States since 1913 is shown in a special survey made by the Department of Commerce. A preliminary report, based on data received from 143 firms with a total revised capacity rating of 208,440 tons per month, shows an increase since 1913 of 45,025 tons in monthly capacity, or about 22 per cent.

Condensed-Clipping Index of Equipment

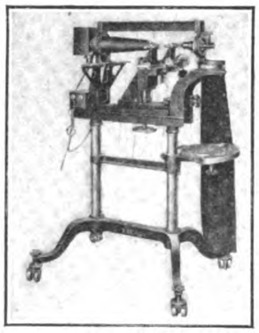
Patented Aug. 20, 1918

Die-Sinking Machine, Automatic, Type F
Keller Mechanical Engraving Co., Brooklyn, N. Y.
"American Machinist," November 9, 1922



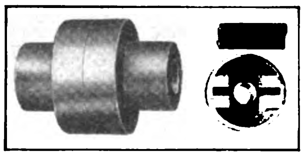
The machine is intended for work in which impressions up to 36 x 20 in. and 8 in. in depth must be made. The work table has horizontal feeding movement as well as quick-return movement. The vertical and the in-and-out or transverse movements are in the head. There is also a contouring movement. The control of all movements is electrical, for both the automatic feed and the hand control by pushbuttons. Two separate motors are provided, one a variable-speed of ¾ hp. for controlling the various movements, and the other a 2 hp. d.c. motor connected directly to the lower cone-pulley shaft on the rear. Table: horizontal travel, 36 in.; feed, from 1½ to 12 in. per minute. Range of speed, from 80 to 3,636 r.p.m. Floor space, 9 ft. x 3 ft. 1 inch.

Projector, Contour Measuring
Bausch & Lomb Optical Co., Rochester, N. Y.
"American Machinist," November 9, 1922



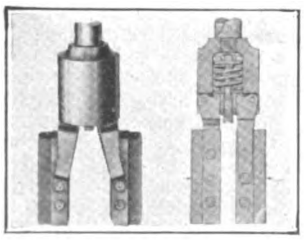
The projector is for inspecting gages, threaded work, gears, form cutters and all sorts of small parts for contour, and after heat-treating for checking to detect distortion. A dark room is not required for operation, as the image is produced on the horizontal table draped with a curtain. The work carrier is a compound slide given three movements by screws with handwheels, the vertical and the lateral movement to position the work, and the third movement to focus the image on the screen. The work may be held between centers or supported by adjustable V-blocks. The adjustable thread chart, lead measuring device, screw holder, gear attachment, two opaque attachments, photographic plate holder, and angle plate can be furnished for attachment to the instrument.

Shaft Coupling, Flexible, "Tilting-Bar"
American Foundry & Manufacturing Co., Frederick, Md.
"American Machinist," November 9, 1922



The coupling consists of only three parts, two flanged hubs with sockets in their faces and a steel bar that fits into the sockets. Flexibility is obtained by tilting and sliding the bar in its sockets, so that parallel, angular and endwise misalignment of the two shaft ends can be accommodated. Except for very slow-speed drive, the sockets are bushed with leather to furnish electrical insulation and give quiet operation. The two hubs of the coupling tend to move toward each other. The coupling is ordinarily fastened to the shaft by means of one setscrew on top of the key and another at right angles to it. Standard sizes, for shafts ¾ to 6½ in. in diameter. Weight: smallest size, 3 lb.; largest, 1,080 pounds.

Tool, Cylinder Finishing, Stoning
Storm Manufacturing Co., 406 Sixth Ave. South, Minneapolis, Minn.
"American Machinist," November 9, 1922

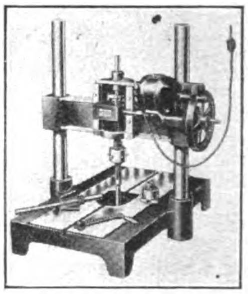


The tool is for finishing the bores of automotive cylinders by polishing or burnishing action after the cylinders have been reamed, rebored or reground. It may be driven by an ordinary drilling machine or by a special driving mechanism furnished. Two abrasive stones of fine texture are carried and rub against the bore when the tool is revolved. They are held in contact with the cylinder wall by the action of the spring in the center of the body, adjusted by the arbor. The spring is usually compressed to about 110 lb. pressure, which is transmitted from the lower disk to the cams on the arms holding the stones. When the tool is off center, all the pressure is transferred to one cam, so that only one stone bears against the work. The action thus tends to center the tool.

Drilling Machine, Sensitive, Ball-Bearing, High-Speed
Sigourney Tool Co., Hartford, Conn.
"American Machinist," November 9, 1922

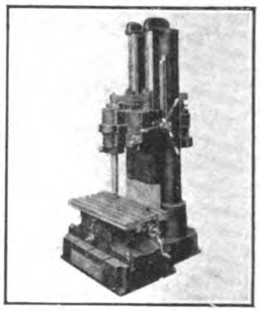
The machines are of both the column and floor types and have single, two, three and four-spindle heads. The spindles are enclosed by telescopic sleeves and their projecting upper ends also are enclosed in stationary removable sleeves. The heads are adjustable vertically upon the face of the brackets for 6 in. The vertical movement of the spindle by rack and pinion is 2 5/16 in. and the moving parts are counter-balanced by concealed springs. A clamp is provided for fine adjustments on each head. Table: Vertical movement on column, 30 in.; dimensions, 9½ x 12½, 12 x 25, 12 x 31 and 12 x 37 in. for one, two, three and four-spindle machines. Weights, 400, 625, 765, and 960 lb., respectively.

Boring Machine, (Re-), Cylinder, "Superior"
Production Machinery Co., Jackson, Mich.
"American Machinist," November 9, 1922



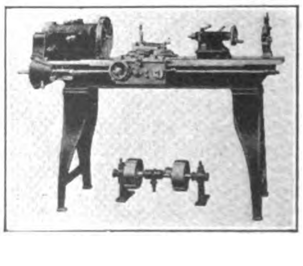
The machine will handle any automobile motor cylinder, and consists of a bed-plate to which the cylinder is clamped, and a cross-rail which carries the working parts. The boring bar is held between two centers. The cutter contains six blades adjusted simultaneously by a handwheel. The machine is furnished complete with two cutter heads, giving a range of from 2 13/16 to 4⅛ in. Four feeds are available by changing the position of the rollers with which the star wheel comes in contact. The machine can be furnished with a ¼-hp. electric motor, or with pulleys for belt drive.

Grinding Machine, Cylinder, Vertical, Williams
Hy-Way Service Co., 225 South St. Joseph St., South Bend, Ind.
"American Machinist," November 9, 1922



In this machine the work lies on the horizontal table with the cylinders vertical. All the driving mechanism is located above the grinding wheel. Longitudinal and transverse screws operated from the front, locate the work table. The entire mechanism for driving the wheel is mounted on the wheel-head, which slides on the vertical column. The 2-hp. motor rotates the grinding spindle at high speed, revolves at low speed the eccentric sleeves carrying the spindle, feeds the head downward, and returns it to the starting position. The eccentricity of the spindle from the center of the spindle unit may be varied from 0 to 1½ in. Holes as small as 2¾ in. in diameter can be ground to a 17 in. depth. Floor space, 37 x 42 in. Weight, 4,000 pounds.

Lathes, Engine, 10-, 12- and 14-Inch
Oliver Machinery Co., Grand Rapids, Mich.
"American Machinist," November 9, 1922



The lathe is made in both cone-pulley and geared-head, single-pulley types. Straight or gap bed, bench or floor legs, oil pan and pump, and countershaft or motor drive can be furnished. Six speeds from 25 to 500 r.p.m. are provided with the cone-pulley headstock. With the geared headstock six speeds, ranging from 32 to 500 r.p.m., are obtainable by shifting two levers. A friction clutch is fitted in the driving pulley. The range of feeds with the change-gear is from 0.0025 to 0.039 in. for all sizes of the machine, and all standard threads from 3 to 40 per inch can be cut. Standard bed lengths, 4 ft. 3 in., 5 ft. 3 in., and 6 ft. Carriage cross-slide travel, 6⅞, 7¼ and 8 in., respectively. Weights, 575, 875 and 1,300 pounds.

Clip, paste on 3 x 5-in. cards and file as desired

Urges Exporters to Help Europe

The only satisfactory way that we can revive foreign trade and aid the American exporter, the American farmer and American business in general is in the finding of ways and means to co-operate effectively with Europe in bringing about in Europe sound money and sound public finance, and, as a consequence, a revival of European industry and European exports, Dr. Benjamin M. Anderson, economist of the Chase National Bank, declared last week, in addressing a luncheon meeting of the American Manufacturers' Export Association at the Hotel Astor, New York City.

Dr. Anderson's subject was, "What Is Happening to Our Foreign Trade?" If the economic life of the world were functioning normally, said Dr. Anderson, we should have an "unfavorable balance of trade," or an import surplus, instead of our present favorable balance of trade, or export surplus. He added that this favorable "balance of trade," which many were afraid would disappear if European trade revived, was a mere bogey.

"The fear is an idle one," said Dr. Anderson. "We have done without comforts and luxuries long enough. Moreover the American market for the products of American industry will not be diminished by the process. Europe will not merely send us goods, but will also provide us with funds with which to pay for them. If goods are sent from France to the United States and sold here, and if at the same time the French Government is making remittances to the United States Government in payment of debts, the French Government will purchase with francs from the French shipper of the goods the dollar credits in New York which have been caused by the shipment of the goods, and will turn these dollar credits over to the United States Treasury.

"The United States receiving dollars from the source, will need to impose less heavy taxation upon the American people, and the American people will have consequently an increased volume of spending power, adequate to take care, not merely of the products of their own industry, but also of the French goods as well.

Business Items

The Terrell Machine Co., of Charlotte, N. C., has amended its charter increasing the capital stock to $100,000 from $25,000, it has been announced by E. A. Terrell, head of the company, the additional capital to be used for expansion purposes during 1923.

The Chapman Valve Manufacturing Co., Springfield, Mass., has declared a stock dividend of 50 per cent, transferring $500,000 from surplus to capital stock. Stockholders of record Dec. 19 will receive three shares for every two previously held by them.

The National Tool Co., Cleveland, Ohio, has acquired the manufacturing rights of the Simmons Method-Hob Co. of 2nd St. and Duncannon Ave., Olney, Philadelphia, Pa.

The Turner & Seymour Manufacturing Co., producers of high quality drapery and upholstery hardware, chain, etc., located at Torrington, Conn., has been purchased by W. R. Bassick, H. L. Sutton, and Willard L. Case.

The Birmingham Iron Foundry, Derby, Conn., manufacturers of rubber mill and rolling mill machinery, has recently increased its capital stock from $300,000 to $1,200,000.

The Fales & Jenks Machine Company, manufacturers of cotton machinery, Pawtucket, R. I., has recently increased its authorized capital stock from $400,000 to $2,000,000.

The Rowbottom Machine Co., manufacturers of automatic machinery, Waterbury, Conn., has increased its capital stock from $10,000 to $100,000, filing a certificate to that effect with the Secretary of the State of Connecticut, during the present week.

The Universal Valve Co., of New Britain, Conn., recently incorporated, elected the following officers during the past week: George LeWitt, president and treasurer; E. P. Burns, vice-president; and M. C. LeWitt, secretary.

The San Diego Supply Company has been incorporated at San Diego, Calif., to carry on the business of building contractor, with a capitalization of $100,000, of which $500 has been subscribed. The incorporators are: Gordon Gray, Union Bldg.; M. J. Irving, W. I. Ames, A. E. Rogers and F. F. Gray.

Sargent & Company, of New Haven, Conn., manufacturers of mechanics' tools, builders' hardware, etc., has voted an increase to its authorized capital stock from $325,000 to $6,500,000.

The Bennett Metal Treating Company, with plant in Elmwood, West Hartford, Conn., has recently incorporated under the laws of Connecticut, with a capital stock of $50,000, to engage in the metal treating business. The firm will begin business with $30,000, and the incorporators are: A. J. Davis, Alvan L. Davis, and H. R. Barker.

The Brown & Sharpe Manufacturing Co., machinery and tool manufacturers, Providence, R. I., during the past week voted a 16,000 per cent stock dividend on their capital stock, thereby increasing it from $100,000 to $16,000,000. This is one of the largest increases in capital stock in the New England States for some time, and while the Brown and Sharpe Co. has always been one of the biggest industries in the East, the capital stock was kept at $100,000. The firm was incorporated in 1868, and employs about 5,000.

The Gilbert & Bennett Manufacturing Co., Georgetown, Conn., manufacturers of wire goods, netting, etc., has increased its capital stock from $2,000,000 to $2,500,000, at a recent meeting of the directors.

Mobile Pulley and Machine Works, formed recently, now has its new Mobile plant in operation producing steel from an electric furnace. This is the first steel producing company in Mobile. A. J. Parsons is president of the concern.

The Southern Metal Trades Association, headquarters of which are in Atlanta, has been advised by the Lucey Manufacturing Co., of Chattanooga, one of its members, of the receipt of a large order for well drilling machinery from Soviet Russia.

The Alabama Manufacturers' Association, in annual convention at Birmingham in mid-December, reaffirmed its stand on the labor question, adopting resolutions strongly opposed to the closed shop and in favor of the American plan of operation in the Alabama industries. L. Sevier was elected president of the body for the ensuing year.

The Birmingham Stove and Range Co., operating a foundry and shops at Birmingham, Ala., is increasing its capital from $122,000 to $213,000 for the purpose of further expanding its business during 1923, according to Bolling H. Jones, of Atlanta, president of the company.

The Foster Machine Co., Westfield, Mass., dedicated its new two-story addition Dec. 14, when the officers of the company were hosts to the employees and their families at an evening party. Motors have been installed and also reflectors to provide an abundance of light. This addition will increase by one-third the company's production of textile and other machinery.

The Hart & Cooley Mfg. Co., at a meeting of the directors last week voted to recommand to the stockholders that a 50 per cent stock dividend be declared and the capital stock be increased from $660,000 to $990,000. The regular quarterly dividend of 3 per cent was declared.

The Southern Spring Bed Co., of Atlanta, is to immediately issue $250,000 in bonds to provide funds for greatly enlarging the capacity of the Atlanta plant, according to an announcement by Robert W. Schwab, president. Present floor space is about 70,000 square feet, and this will be increased to 125,000 square feet.

The Hurley Machine Co., New Haven, Conn., has declared a dividend of 10 per cent on the common stock, payable in common stock and the regular quarterly dividend of cents on the common stock, both payable Jan. 4 to stock of record Dec. 28.

The Westinghouse Electric and Manufacturing Co. has leased a six story building to be erected on a lot 100 x 150 feet at Jones Ave. and Marietta Street, Atlanta, Ga., at a cost of $360,000. The building, which is to be known as the Westinghouse Electric Building, will be constructed according to the company's specifications and will be used as an office, warehouse, and service station. Construction work was started Dec. 1 and will probably be completed by next May.

The Ingersoll-Rand Co. and the A. S. Cameron Steam Pump Works announce the opening of a branch office at 718 Ellicott Square Building, Buffalo, N. Y. This new office is equipped to render full service to those interested in air, gas and ammonia compressors, vacuum pumps, turbo blowers and compressors, condensers oil and gas engines, pneumatic tools, rock drills, centrifugal and direct-acting pumps and other of the numerous products manufactured by these Companies.

The Ramona Supply Co. of Ramona, Calif., has been incorporated for the purpose of carrying on a wholesale lumber and machinery business. The incorporators are A. C. Bisher, Pearl Bisher and Warren Libby, the first two living at Ramona and the latter at San Diego, Calif.

Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

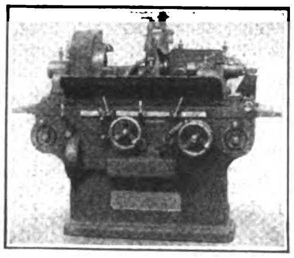
Press, Broach, Bench, on Pedestal
American Broach & Machine Co., Ann Arbor, Mich.
"American Machinist," November 16, 1922

The power-operated press is intended especially for broaching small holes and keyways, and is operated by belt on a constant-speed pulley. Power is transmitted through a worm and worm gear to the ram. The ram is controlled by a positive jaw clutch and is raised by a counterweight after the power has been disengaged. The machine is fitted with an automatic stop. It can also be operated by hand power. Approximately 2 tons pressure can be obtained. An oil receptacle in the pedestal can be connected to an oil pump. The table has a $2\frac{1}{2}$ in. hole. Maximum stroke, 14 in. Capacity, work 6 in. in diameter. Height table to floor, 36 in. Weight with pedestal, 315 pounds.

Reamer, Line, Expansion, Piston, "Nu-Angle"
Vedoe-Peterson Co., Norfolk Downs, Mass.
"American Machinist," November 16, 1922

The reamer is used in reaming piston-pin bushings. The six blades are placed at angles to the axis so as to minimize chatter and gouging. The size can be adjusted through a range of 0.030 in. The tool is equipped with a pilot and an expanding sleeve, so that the two holes in the bushing will be exactly aligned. The tool is guided and supported by the solid pilot and the expanding sleeve on one bearing while reaming the opposite bearing. The reamer is made in nine sizes. The diameters available range from 0.66 to 1.14 in. and the lengths from $9\frac{1}{2}$ to $12\frac{1}{2}$ in. Three reamers can be furnished to ream the piston-pin bushings employed in the great majority of automobile motors. The tools are packed in wooden boxes.

Grinding Machine, Cylindrical, Plain, 12-Inch
Cincinnati Grinder Co., Oakley, Cincinnati, Ohio
"American Machinist," November 23, 1922

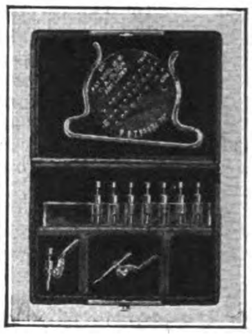


The working mechanism has been redesigned, and the machine is intended for grinding straight or tapered spindles, shafts, rolls or any work revolved on centers. It is made in 18, 24, 36, 48 and 72-in. work lengths, with either belt or motor drive. The spindle is driven directly from the countershaft. Control is centralized on the front of the machine. Any unit may be easily removed. The spindle and the table have six work speeds each, obtained through a single gear box. When the power traverse to the table is engaged, the handwheel is automatically disengaged and remains stationary during the table travel. When the power traverse is disengaged, the handwheel is automatically engaged. The crossfeed may be either hand or automatic.

Garage Tools, Valve-Reseater, Piston Sleeves, "Speed Up"
Stevens & Co., 375 Broadway, New York, N. Y.
"American Machinist," November 23, 1922

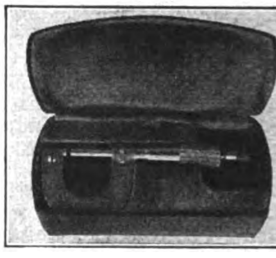
The tools are for use in repairing automotive engines. By means of the reseating tool at the left, valves on all 45-deg. removable-head motors can be reseated. It is not necessary to change the pilots or cutters for different sizes. The pilot is made in one piece, stepped off for four sizes of valve stems, $\frac{5}{16}$, $\frac{3}{8}$, $\frac{7}{16}$ and $\frac{1}{2}$ in., each step being slightly tapered. The pilot telescopes into the handle and is forced outward by means of a coil spring, seating itself in the valve guide. The sleeves on the right are for fitting rings to pistons, and can also be used when slipping assembled pistons into the cylinder block. The sleeve is split and is made in five sizes to fit diameters from $2\frac{3}{8}$ to $5\frac{1}{2}$ inches.

Draftsmen's Set, "Leroy & Ames," No. 100
Edgar Bourquin, 1353 Main St., Waltham, Mass.
"American Machinist," November 16, 1922



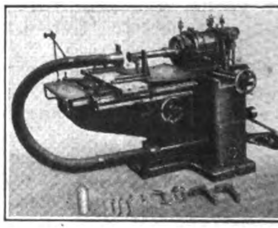
The set consists of pens and a lettering instrument for the use of draftsmen and engineers. The Ames lettering instrument is a steel frame holding a celluloid disk which may be rotated in it. In the disk are three parallel rows of tapered holes for drawing guide lines for lettering. Compartments hold the pens, with a special celluloid holder for the Leroy tubular pens. The pens are of the fountain type and are adaptable to both ruling and lettering. Each tube has a removable cleaner. The width of the line made depends upon the width of the point, and the tube points are interchangeable in the swiveling socket, which can also hold Gillott's crow quill pens. Smaller sets than shown can be furnished.

Micrometer Case, Pocket
Brown & Sharpe Manufacturing Co., Providence, R. I.
"American Machinist," November 16, 1922



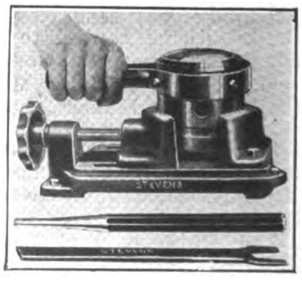
The case is for holding 1-inch micrometer calipers and is designed to fit the pocket without taking up much room or causing a large bulge. Its use protects the micrometer from dirt or injury when carried in the pocket. The case is made of metal covered with leather and lined with plush. It is furnished in two styles, the No. 202 for the standard micrometer made by the concern, and the No. 203 for the "Rex" micrometer. The inside of the case is so shaped as to hold the micrometer securely in position and prevent it from moving.

Grinding Machine, Cylinder, "Madison"
Gisholt Machine Co., Madison, Wis.
"American Machinist," November 23, 1922



The machine is adaptable to all kinds of automotive cylinders with the use of the standard equipment only, and can be employed on either open-head or closed-head cylinder blocks. The wheel spindle is of the two-piece type, and so for average work the outer spindle can be short and rigid. The rotary motion of the eccentric sleeve is controlled through a friction clutch and the amount can be adjusted while the head is in motion. The horizontal adjustment of the wheel to the work is obtained by movement of the wheel carriage. The work table can be moved vertically, as well as parallel to the wheel spindle to feed the cylinders to the wheel. Adjustable stops automatically trip and reverse the feed. An exhaust fan is mounted on the base. Floor space, 71 x $57\frac{3}{4}$ in. Weight, 2,600 pounds.

Garage Tools, Piston Vise, Groove Cleaner, Punch and Prongs, "Speed Up"
Stevens & Co., 375 Broadway, New York, N. Y.
"American Machinist," November 23, 1922



The vise is for holding pistons, speedometer heads, clocks, ball bearings and universal-joint parts. Four points of contact on the work are provided, the jaws being lined with lead. Capacity, $5\frac{1}{2}$ in. in diameter. Weight, 13 lb. The cleaner is a metal band with four V-shaped points on the inside fitting into the piston groove. It is made in two sizes for pistons $3\frac{3}{8}$ in. in diameter and over, and for smaller pistons. The 12 in. Giant punches are for use in lining up holes for assembling and in driving pins and bolts. They are made in three sizes having point diameters of $\frac{3}{8}$, $\frac{5}{16}$ and $\frac{1}{4}$ in. The 16-in. utility prong is for general use when repairing parts.

Clip, paste on 3 x 5-in. cards and file as desired

Personals

James A. Bennett has recently been appointed sales manager of the Connecticut Telephone & Electric Co., manufacturers of telephone and electrical supplies, Meriden, Conn.

Frank L. Cogill, president of the Coulter & MacKenzie Machine Co., manufacturers of machinery, etc., Bridgeport, Conn., has returned to this country, after an extensive business trip through the European countries.

C. G. Hoerle, secretary of the Union Hardware Co., hardware manufacturers, of Torrington, Conn., has recently been appointed an Aide-de-Camp on the Staff of Governor-elect Charles A. Templeton, of Connecticut.

Clifton T. Brownell, president of the Brownell Machinery Co., dealers in machinery, 11 Eddy St., Providence, R. I., has purchased for his concern the property and buildings at the corner of Waterman and East River Streets, Providence. The lot consists of about 77,000 square feet of land, and the wooden buildings on same will be utilized as storage space of machinery by the Brownell Company.

General Lucius B. Barbour of Hartford, Conn., has been elected a director of the Landers, Frary & Clark Corp., manufacturers of cutlery, tools, etc., New Britain, Conn., to succeed his father, the late General Lucius A. Barbour.

Charles N. Replogle, well known in the iron and steel business of the country, and formerly general manager of the Cambria Steel Co., was recently elected president and general manager of the Brightman Manufacturing Co. of Columbus, Ohio, succeeding W. C. Wagoner.

E. J. Perkins, president of the Bessemer Metal Products Co., of Bessemer, Ala., advises that the company plans to manufacture a more or less complete line of metal automobile parts, including pistons, piston rings, connecting rods, etc.

George U. Hatch has been elected vice-president of the Millers Falls Co., Millers Falls, Mass., and will continue to have charge of sales, a position he he filled for three years since leaving the sales organization of the Winchester Repeating Arms Co.

Frank B. Adams of Greenfield, Mass., has resigned as commercial representative of the New England Telephone and Telegraph Co. in that district to become director of welfare and first aid for the Detroit Steel Products Co., Detroit, Mich., for which concern his son is sales manager.

A. L. Meyers, who has been connected with the R. K. LeBlond Machine Tool Co., Cincinnati, for the past sixteen years, has been transferred from the general superintendency of that company to the sales force of the same corporation and will have charge of the field work.

Frank Hoffstetter, who has been assistant superintendent of the R. K. LeBlond Machine Tool Co., Cincinnati, has resigned his position to go with the Seifert & Woodruff Co., of Cincinnati. He will have charge of the sales end of their machine tool supplies.

E. C. Brandt, works manager of the Westinghouse-Krantz Works, has been appointed works manager of the new plant now being erected by the Westinghouse Electric & Manufacturing Company in Homewood, Pittsburgh.

W. R. Bassick, formerly vice-president and general manager of the Bassick Co., Bridgeport, Conn., has been elected president of the newly formed Turner & Seymour Manufacturing Co., Torrington, Conn.

H. L. Sutton, formerly general manager of the American Tube and Stamping Co., has been elected vice-president of the Turner & Seymour Manufacturing Co., Torrington, Conn.

Willard L. Case, formerly treasurer of the Yale & Towne Manufacturing Co., has been elected secretary-treasurer of the newly formed Turner & Seymour Manufacturing Co., Torrington, Conn.

G. Mil Horton, general manager of the Cisco Machine Tool Co., has tendered his resignation to take effect Jan. 1, 1923.

Elbert E. Lochridge, chief engineer of the Springfield municipal water system, has been elected president of the Engineering Society of Western Massachusetts to fill the vacancy caused by the recent death of Dr. Herbert C. Emerson.

Charles A. Bickett, formerly with the Bickett Machine and Manufacturing Co., has organized a new plant, under the name of Bickett-Miller Co., to continue the manufacture of the Bickett line of bench millers and do special engineering and machine work.

Obituary

John H. Bass, 87 years old, manufacturer and philanthropist, died at his home in Fort Wayne, Ind., last week after a lingering illness. Mr. Bass was the founder of the Bass Machine and Foundry Co. of that city. In addition to extensive industrial and commercial interests in Fort Wayne, he was identified with manufacturing plants in Chicago, St. Louis and in mining and steel industries in Alabama and Tennessee.

Fred A. Marsh, the general purchasing agent of the Link-Belt Co., died at his home, No. 6436 Greenwood Ave., Chicago, Dec. 11, at the age of 52 years. Mr. Marsh was a member of the Link-Belt organization for over 33 years, was one of the organizers of the Purchasing Agents Association of Chicago, and served as its first president. He was also for several years a director in the National Association of Purchasing Agents.

Don H. Bacon, formerly president of the Tennessee Coal, Iron and Railroad Co., and who retired from active business life in 1906, died recently at his home in St. Augustine, Fla., where he lived during the winter months. His summer home was at New York City. Prior to becoming president of the Tennessee Company, Mr. Bacon was with the Minnesota Iron Co. in an executive capacity at the time this concern was purchased by the United States Steel Corporation. During this period he was prominently identified with the iron development of the northwest. He built a winter home at St. Augustine in 1916.

George J. Foster, a life long resident of Montreal, died Dec. 20, at the age of 50. Mr. Foster was president and managing director of Steel Specialties Co. of Canada, Ltd.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

Electrical refrigerators for homes—Switzerland. Agency desired. Quotations, f. o. b. New York. Terms: Payment against documents. Catalogs requested. Reference No. 4754.

Small electric heaters for home use, and electrical machinery and apparatus of all kinds—Spain. Purchase desired. Quotations, c. i. f. Corunna or Vigo. Terms: Cash against documents in New York. Correspondence, Spanish or French. Reference No. 4755.

Hardware, utensils, tools, valves and automobile supplies—Italy. Agency and purchase desired. Quotations, c. i. f. Genoa. Reference No. 4718.

Hardware, including tools, locks, axes, hatchets, paints and varnishes, and watches and clocks—South Africa. Agency desired. Reference No. 4717.

Hardware, tools and implements of every description — Poland. Agency desired. Quotations, c. i. f. Danzig. Reference No. 4719.

Forthcoming Meetings

American Engineering Council, Annual Meeting, January 11 and 12, at the headquarters of F. A. E. S., 24 Jackson Place, Washington, D. C. L. W. Wallace, Secretary.

National Automobile Chamber of Commerce, National Automobile Show, January 27 to February 3, 1923, Coliseum and First Regiment Armory, Chicago, Ill.

Society of Automotive Engineers, annual meeting, Jan. 9 to 12, 1923, Engineering Societies Building, 29 West 39th St., New York City. C. F. Scott is chairman.

American Institute of Electrical Engineers, Mid-Winter Meeting, February 14 to 16. Engineering Societies Bldg., New York. F. L. Hutchinson, Secretary.

American Society for Steel Treating, Winter Sectional Meeting, City Club, Chicago, Ill., Feb. 15 and 16, 1923. National Secretary, W. H. Eisenman, 4600 Prospect Ave., Cleveland, Ohio.

Universal Patent Exposition, First Annual Convention and exhibit of patents and inventions, Grand Central Palace, New York City, February 17 to 22, 1923. A. B. Cole, 110 West 40th St., New York City, is chairman.

American Institute of Mining and Metallurgical Engineers, Annual Meeting, February 19 to 21. Engineering Societies' Bldg., New York. F. S. Shartless, Secretary.

American Foundrymen's Association, Annual convention, and exhibition at Public Hall, Cleveland, Ohio, April 30 to May 3, 1923. C. E. Hoyt, 140 South Dearborn St., Chicago is secretary.

American Electro Chemical Society, Semi-annual meeting, Hotel Commodore, New York City, May 3 to 5, 1923. Colin G. Fink, 327 South La Salle St., Chicago, Ill., is secretary.

National Supply and Machinery Dealers' Association; Southern Supply and Machinery Dealers' Association; and the American Supply and Machinery Manufacturers' Association, triple convention, in Cincinnati, Ohio, May 17, 18, 19, 1923. F. D. Mitchell, 1819 Broadway, New York City, is secretary.

American Society for Testing Materials, Annual meeting at Atlantic City, June, 1923. C. L. Warwick, 1315 Spruce St., Philadelphia, is secretary.

The Weekly Price Guide

RISE AND FALL OF THE MARKET

Advances—Current business on steel shapes, plates and bars, firm at $2 per 100 lb., Pittsburgh, despite weakening of market in light rails and forging billets. On especially attractive tonnages $1.90 is possible, particularly for car material. The minimum on bars, however, is placed at $1.95, and that to large and preferential buyers only. Copper, lead and tin markets all firmer in tone. Electrolytic copper, up ½c.; tin, 1½c. and lead ½c. per lb. in New York warehouses during week. Copper sheets, wire and tubing advanced ½c. and copper bars, brass sheets and wire, ¼c. per lb. Old metals, non-ferrous, also up ½c.@1½c. per lb.

Declines—Zinc quoted at 7½c. as against 7⅝c. per lb. in New York warehouses, despite firmness of other metals. Linseed oil market sluggish but prices steady. Coke, both furnace and foundry, down 50c. per ton during week.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$27.05
Northern Basic	29.27
Southern Ohio No. 2	28.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	34.44
BIRMINGHAM	
No. 2 Foundry	23.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	29.14
Virginia No. 2	34.17
Basic	27.50
Grey Forge	28.64
CHICAGO	
No. 2 Foundry local	28.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	29.01
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	25.00
Basic	25.00
Bessemer	27.50

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	6.0
Cleveland	5½@6
Cincinnati	4.5@6
New York	5.5
Chicago	4@5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 50	4.19	3.70	4.00
No. 12	2.60	4.24	3.75	4.05
No. 14	2.70	4.29	3.80	4.10
No. 16	2.90	4.39	3.90	4.20
Black				
Nos. 17 and 21.	3.20	4.30	4.20	4.70
Nos. 22 and 24.	3.25	4.35	4.25	4.70
Nos. 25 and 26.	3.30	4.40	4.30	4.75
No. 28	3.35	4.50	4.40	4.85
Galvanized				
Nos. 10 and 11.	3.35	4.50	4.40	4.85
Nos. 12 and 14.	3.45	4.60	4.50	4.95
Nos. 17 and 21.	3.75	4.90	4.80	....
Nos. 22 and 24.	3.90	5.05	4.95	5.40
No. 26	4.05	5.20	5.10	5.55
No. 28	4.35	5.50	5.40	5.90

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	Iron Inches	Black	Galv.
BUTT WELD					
1 to 3	66	54½	¾ to 1½	34	19
LAP WELD					
2	59	47½	2	29	15
2½ to 6	63	51½	2½ to 4	32½	19
7 to 8	60	47½	4½ to 6	32½	19
9 to 12	59	46½	7 to 12	30	17
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	64	53½	¾ to 1½	34	20
2 to 3	65	54½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	57	46½	2	30	17
2½ to 4	61	50½	2½ to 4	33	21
4½ to 6	60	49½	4½ to 6	32	20
7 to 8	56	43½	7 to 8	25	13
9 to 12	50	37½	9 to 12	20	8

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded.	57%	44%	55½%	43½%	62½%	48½%
2½ to 6 in. steel lap welded.	54%	41%	53½%	40½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 6%. Cast iron, standard sizes, 32% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.03	8.00	6.10
Hoop steel	4.39	3.71	3.90
Cold rolled strip steel	6.75	8.25	7.25
Floor plates	5.50	5.16	5.50
Cold finished shafting or screw	3.90	3.75	3.70
Cold finished flats, squares	4.40	4.25	4.20
Structural shapes (base)	3.14	3.01	3.02½
Soft steel bars (base)	3.04	2.91	2.92½
Soft steel bar shapes (base)	3.04	2.91	2.92½
Soft steel bands (base)	3.84	3.61	3.55
Tank plates (base)	3.14	3.01	3.02½
Bar iron (2.60 at mill)	3.04	2.91	2.92½
Drill rod (from list)	55@60%	40%	50%
Electric welding wire:			
3/32	8.00		12@13
⅛	6.50		11@12
5/32 to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York	15.37½
Tin, 5-ton lots, New York	39.00
Lead (up to carlots), St. Louis	7.05; New York. 7.62½
Zinc (up to carlots), St. Louis	7.05; New York. 7.50

	New York	Cleveland	Chicago
Aluminum, 98 to 99% ingots, 1-15 ton lots	25.20	23.00	23.00
Antimony (Chinese), ton spot	7@7.25	8.37½	7.75
Copper sheets, base	22.00	22.00	23.00
Copper wire (carlots)	16.50	18.00	16.25
Copper bars (ton lots)	20.25	23.00	19.50
Copper tubing (100-lb. lots)	25.25	25.00	23.00
Brass sheets (100-lb. lots)	18.75	20.75	18.75
Brass tubing (100-lb. lots)	23.00	24.00	20.50

—Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Brass rods (1,000-lb. lots)	17.00	19.00	15.75
Brass wire (carlots)	19.25	20.75	.....
Zinc sheets (casks)	10.25	10.25	.....
Solder (½ and ½), (caselots)	27.50	24.75	20.00
Babbitt metal (83% tin)	42.00	47.00	36.00
Babbitt metal (35% tin)	25.00	17.50	.....
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	12.50	12.50	12.00
Copper, heavy, and wire	12.25	11.75	11.50
Copper, light, and bottoms	10.50	10.00	10.50
Lead, heavy	5.75	5.50	5.75
Lead, tea	5.25	4.50	4.75
Brass, heavy, yellow	7.00	....	....
Brass, heavy, red	9.50	9.50	9.50
Brass, light	6.00	5.50	6.00
No. 1 yellow brass turnings	7.00	6.50	7.00
Zinc	4.50	4.00	4.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

			New York	Cleveland	Chicago
"AAA" Grade:					
IC,	20x28,	112 sheets	20.00	18.25	18.50
IX,	20x28,	112 sheets	23.00	21.00	20.90
"A" Grade:					
IC,	20x28,	112 sheets	17.00	16.00	17.00
IX,	20x28,	112 sheets	20.00	18.75	19.60
Coke Plates, Bright					
Prime, 20x28 in.:					
100-lb.,		112 sheets	12.00	11.50	14.50
IC,		112 sheets	12.30	11.90	14.80
Terne Plate					
Small lots, 8-lb. Coating:					
100-lb.,	14x20		7.00	6.00	7.25
IC,	14x20		7.25	6.25	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.09@$0.11½	$0.12	$0.11½
Cotton waste, mixed, per lb.	.065@.10	.09	.08
Wiping cloths, 13½x13½, per lb.	.16	32.00 per M	.10
Wiping cloths, 13½x20½, per lb.	.20	48.00 per M	.13
Sal soda, 100 lb. lots	2.80	2.40	2.65
Roll sulphur, per 100 lb.	2.90	3.25	3.50
Linseed oil, per gal., 5 bbl. lots.	.93	1.01	.95
White lead, dry or in oil	100 lb. kegs.	New York, 13.25	
Red lead dry	100 lb. kegs.	New York, 13.25	
Red lead, in oil	100 lb. kegs.	New York, 14.75	
Fire clay, per 100 lb. bag		.65	
Coke, prompt furnace, Connellsville... per net ton		$6.50	
Coke, prompt foundry, Connellsville... per net ton		7.00@7.50	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in.	40%	50-10-5%	50%
1⅛ and 1¼x3 in. up to 12 in.	20%	50%	50%
With cold punched sq. nuts	25%	$3.50 net	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	30%	3.50 net	$4.00 off
Button head bolts, with hex. nuts	15%	3.90 net	.....
Hex. head and hex. nut bolts	20%	....	65-5%
Lag screws, coach screws	40%	....	60-5%
Square and hex. head cap screws	75%	70%	70-10%
Carriage bolts, up to 1 in. x 30 in.	30%	40-10%	45%
Bolt ends, with hot pressed nuts	40%	....	55%
Tap bolts, hex. head, list plus	20%	....	.....
Semi-finished nuts ⅝ and larger	60%	70%	80%
Case-hardened nuts	50%	....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$6.00	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	4.50	4.00	3.50
Washers, round plate, per 100 lb. Off list	3.00	5.00	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, sq., per 100 lb. Off list	1.00	3.00	4.00
Nuts, cold punched, hex., per 100 lb. Off list	1.00	3.00	4.00
Rivets:			
Rivets, 7/16 in. dia. and smaller	45%	60%	60%
Rivets, tinned	50%	60%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb. (net)	$5.00	$3.90	$3.75
Cone heads, ditto (net)	5.10	4.00	3.85
1⅛ to 1⅞-in. long, all diameters, *EXTRA* per 100 lb.	0.25	....	0.15
⅝ in. diameter *EXTRA*	0.15	....	0.15
½ in. diameter *EXTRA*	0.50	....	0.50
1 in. long, and shorter *EXTRA*	0.50	....	0.50
Longer than 5 in. *EXTRA*	0.25	....	0.25
Less than 200 lb. *EXTRA*	0.50	....	0.50
Countersunk heads *EXTRA*	0.35	...	$3.70 base
Copper rivets	55-5%	50%	50%
Copper burs	35%	50%	20%

	New York	Cleveland	Chicago
Lard cutting oil (50 gal. bbl.) per gal.	$0.50	$0.50	$0.67½
Machine lubricant, medium-bodied (50 gal. bbl.), per gal.	0.33	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, New York, per ply, 12-in. wide, per lin. ft., $2.88:			
Medium grade	30-10%	40½%	50%
Heavy grade	20-5-2½%	30-5%	40-5%
Rubber and duck:			
First grade	60-5%	50-10%	40-10%
Second grade	65-10%	60-5%	60-5%
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.84	$5.84	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	31.12	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll.	4.50	4.28	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.24	1.40
Cloth	3.02	2.67	3.20

New and Enlarged Shops

Machine Tools Wanted

Ark., Fort Smith—T. H. Lyon, 1004 Garrison Ave.—jeweler's electric power lathe.

Calif., Eureka—Bd. Educ., G. B. Albee, Secy., receiving bids until Jan. 2, one No. 1½ Cincinnati Universal cutter and tool grinder, complete with cylindrical grinding attachment; internal grinding attachment; gear cutter sharpening attachment; surface grinding attachment; case for storing the parts and attachments; trueing diamond and holder; one engine lathe, 14 in. swing, 6 ft. 6 in. bed, quick change gears and 2 semi-finished chuck plates, follower rest and standard equipment and taper attachment for one lathe; Lodge & Shipley or equal (a) single pulley or constant speed drive (b) cone drive (c) one to six in. 3 jaw Universal chuck, inside and outside jaws for each lathe (%)1- 12 in. independent chuck for each lathe; one 12 in. Clizby imperial grinder head with counter-shaft and guards; one Metcalf emery wheel dresser, type A; one Buffalo combine armor plate punch and shear with metal stand (a) No. 3 B (b) No. 4 B; one Wicks continuous blue print machine No. 15 for A. C. 110 volt, 60 cycles; two No. 2 double Superior soldering furnace (for manufactured gas); one Oxweld or equal low pressure acetylene gas generator, 50 lb. capacity and the following equipment: one welding blowpipe complete with 5 welding heads, one cutting blowpipe complete with 5 nozzles; four sheet metal blowpipes complete with tips, one lead burning blowpipe complete with tips, one oxygen cutting regulator, 2 guages; 5 r-8 oxygen regulators. Alternate bid, welding outfit: provide the number of torches as listed, and all other necessary equipment so that gas from acetylene cylinders may be used in place of the acetylene generator. Bids must specify items to be furnished which must include truck to make the outfit easily portable. Sheet metal equipment: one No. 681 cornice break, one No. 381 slip roll pattern forming machine, one No. 137 B squaring shear, one No. 548 wiring machine, one 4 in. Wiss combination snips, one No. 911 hollow mandrel stake, one No. 925 blowhorn stake, one No. 935 coppersmiths squaring stake, two 14 oz. riveting hammers, one No. 63 folding machine, one No. 587 crimping and beading machine, one No. 547 turning machine, one Pexto bench shear No. 3, one 4 in. Bartlett compound lever snips, one No. 901 Beakhorn stake, one No. 931 bevel edge squaring stake, one No. 941 hatchet stake, one 14 oz. setting hammer, one rivet set.

Ill., Chicago—Pullman Co., East 112th St. and Cot Grv.—one 18 in. slotter; one 48 in. open side planer with a 20 ft. bed; one 5 or 6 ft. radial drill; one 10 in. slotter; one 36 in. x 36 in. x 8 ft. bed, or longer, planer with 4 heads; one 36 in. swing heavy duty drill press with compound table and tapping attachments; one 20 in. shaper.

Mass., Cambridge—Cambridge Motor Co., 195 Massachusetts Ave. — machinery and equipment for garage.

Mich., Detroit—F. Colman & Sons, 1520 15th St., (tool work)—grinders and miscellaneous machine shop equipment.

Wash., Centralia—McDowell Bros., 721 North Tower St.—one quick change machinist's lathe, 16 to 18 in. swing, 8 ft. bed, electric drive; one welding outfit complete, either gas or electric; one 2 wheel pedestal grinder, 1 wet, 1 dry wheel.

Wis., Janesville—J. A. Strimple, 219 East Milwaukee St.—power and automobile repair machinery, also pumps, for proposed garage.

Wis., Madison—Capitol City Garage Co., South Pinckney St.—power machinery and automobile repair machinery for proposed $60,000 garage on Washington St.

Machinery Wanted

Ala., Auburn—Young Lumber Co.—machinery and equipment for lumber mill, to replace that which was destroyed by fire.

Ark., El Dorado—H. Byrens, Box 1025, (oil producer)—two oil pumps, one visible gasoline pump, air compressor, five 5,000 barrel oil tanks and 6, 8 and 10 in. pipe.

Ill., Chicago—H. J. Delson Co., 749 North Western Ave., (job printer)—14 x 22 in. and 13 x 19 in. presses, also motors for same.

Ill., Peoria—Meyer Furnace Co., 1300 South Washington St.—equipment for furnace factory, to replace that which was destroyed by fire.

Ind., Fort Wayne—Fort Wayne Box Co., Calhoun and Superior Sts.—machinery for proposed box factory.

Ky., Ashland—Amer. Rolling Mill Co.—cranes.

Ky., Louisville—Mengel Body Co., A. Allen, Pres.—machinery and equipment for the manufacture of auto truck bodies.

Mass., Dorchester (Boston P. O.) — W. Marade Co., 387 Bowdoin St., (manufacturer of advertising specialties) — multicolor press (used).

Mass., Fitchburg — Star Worsted Co.—machinery, including looms, etc., for addition to woolen mill.

Mass., South Braintree (Boston P. O.)—H. W. Bailey & Co.—folding machine large enough for 7 column newspaper.

Mass., Worcester, — Queensbury Mills. Inc., Quinsigamono Ave.—machinery for additions to yarn mill.

Mich., Detroit—E. Eichman, 3102 Roosevelt Ave.—equipment for the manufacture of patented expander and contractor for automobile tires.

Mich., Detroit—Ervin Stamping Co., 25 East Atwater St., (metal stamping)—miscellaneous equipment for making metal parts; shop trucks; dipping tanks for enameling.

Mich., Detroit—Stewart Auto Top Co., 83 East Milwaukee Ave.—band saw and equipment.

Mich., Grand Rapids—Bd. Educ., H. Morrill, Business Mgr., City Hall — manual training equipment for proposed Junior High School.

Miss., Moss Point—Southern Paper Co.—machinery and equipment for pulp paper mill.

Mo., Joplin—W. W. Kersey, 2005 Empire Ave.—oil driller.

Mo., St. Louis — Germo Mfg. Co., 111 South Main St.—two steel-jacketed, 500 gal. kettles.

Mo., St. Louis—Z. Zimmerly, 5532 Magnolia Ave.—7 x 11 in. Pearl or 8 x 12 in. Chandler-Price printing press

Neb., Omaha—Union Pacific R.R., 15th and Dodge Sts., G. G. Smith, Purch. Agt.—$5,900,000 worth of equipment, including 78 new freight engines.

N. Y., Addison—H. Austin—ice cream manufacturing machinery for plant at Canisteo.

N. Y., Jamestown—Jamestown Metal Desk Co., 104 Blackstone Ave.—machinery and equipment for proposed addition to factory.

N. Y., Rochester—G. Sianord, 1839 Highland Ave.—one power drag saw and equipment.

O., Columbus—W. E. Lamneck Co., 5th Ave. along tracks of Hocking Valley R.R., (manufacturer of furnaces and metal products), A. P. Lamneck, Secy. and Treas.—metal working machinery to enlarge plant.

O., Lima—Lima Sheet Metal Wks.—sheet metal working machinery.

O., London—M. J. Kehoe Co.—machinery for the manufacture of power washing machines.

O., Washington C. H.—G. D. Baker & Co., (manufacturer of hardwood flooring)—woodworking machinery, including saws, planers, molders, etc.

Ore., Astoria—Hammond Lumber Co.—machinery and equipment for saw and planing mill, and sash, door and box factory.

Pa., Allentown—Lehigh Valley Poster Co.—machinery and equipment for proposed poster plant.

Pa., Etna (Pittsburgh P. O.) — Spang Chalfant Co.—10 ton crane.

Pa., Hughesville—Hughesville Furniture Co., W. M. Engel, Pres.—machinery and equipment for additions to furniture plant.

Pa., Lancaster—J. H. Hartman, Elizabeth Ave. and Plum St.—machinery and equipment for the manufacture of toy banks, etc.

Pa., Mars—Velte Fdry. and Machine Co.—pattern shop and foundry equipment.

Pa., Monessen—Monessen Fdry. and Machine Co.—10 ton crane.

Pa., Oil City—T. F. Fleickenstein—bakeshop equipment.

Pa., Pittsburgh—Carnegie Steel Co., Carnegie Bldg.—Gantry crane for West Braddock docks.

Pa., Pittsburgh—Pennsylvania R.R., Pennsylvania Sta., W. G. Phelps, Purch. Agt.—600 ton wheel press.

Pa., Sharon—H. J. Chadderton—coal coal mining machinery and equipment for coal deposits to be developed near Mercer.

Pa., Slatington—O. B. Brush Co., J. G. Rauch, Dir.—machinery and equipment for the manufacture of brushes.

Pa., Titusville—Cycloys Steel Co., C. T. Evans, Supt.—machinery and equipment for the manufacture of a new process combination metal and alloy steel.

Pa., Yorkhaven—E. E. Brunner, c/o State Bank—machinery and equipment for the manufacture of paper and saturating felt.

Tex., Fort Worth—Alford Ice Co., Jasemine and Jennings Sts.—$45,000 worth of ice machinery.

Tex., Port Arthur—Bd. Educ.—lathes, planers, etc., for manual training department of proposed grade school.

Va., Alexandria—G. Carroll, Box 11—machinery for the manufacture of electric storage batteries.

Va., Bristol—Lincoln Furniture Co., C. Lincoln, Pres.—machinery and equipment for $100,000 addition to plant.

W. Va., Ronceverte—Midland Smokeless Coal Co., C. Thompson, Pres.—conveying, transmission machinery and other mine equipment.

Wis., Almond—A. Pagel—machinery and equipment for new feed grinding mill.

Wis., Crandon—Forest County Bd., F. J. Rogers Comnr.—$8,000 worth of road machinery, including gravel crushing equipment.

Wis., Marshfield—L. Kohl, 110 West 4th St.—mechanical equipment for baking process, to bake paint on automobiles.

Wis., Milwaukee—Gas Tank Recharging Co., 1245 23rd Ave.—air compressors for proposed plant at West Allis.

Wis., Milwaukee — Milwaukee Vinegar Co., 79 Buffalo St.—yeast presses and hoppers for proposed yeast house at Cudahy.

Wis., Ripon—Ripon Produce Co., A. E. Wells, Secy.—power and dairy machinery for proposed plant at Stetsonville.

Wis., Sheboygan—Sheboygan County Bd., G. W. Ubbelohde, Chn., Court House,—gravel pit machinery, conveyors, etc., for road use.

Wis., South Madison (Madison P. O.)—Bd. Educ., E. Reggert, Chn.—manual training equipment for new high school.

Wis., Waunakee—Waunakee Canning Co., c/o A. P. Kenney, Waunakee State Bank—canning machinery and power machinery for proposed factory.

Ont., Cobalt—Coniagas Mines, Ltd.—crushing equipment to enlarge production to 150 ton per day.

Ont., Midland—Pratt & Shanacy, (lumber), J. Pratt, Purch. Agt.—one lath machine and one bolter, capacity 35,000 per day.

Ont., Niagara Falls—Twp. of Stamford, T. R. Stokes, Clk.—rock crusher.

Ont., Ottawa—Dept. Public Wks., R. C. Desrochers, Secy.—receiving bids until Jan. 31, dry dock machinery for Esquimalt, B. C.

Ont., Ottawa—McAuliffe-Davis Lumber Co.—woodworking machinery.

Ont., Timmins—Hollinger Consolidated Gold Mines, Ltd.—machinery to double present capacity of plant, (4,500 ton per day), including crushers, drills, conveying equipment, stamp mills, amalgamators, etc.; also cranes for proposed power plant.

Que., Lachine—La Pailleur Freres, Ltd., 405 St. Joseph St., L. LaPaulteur Purch. Agt.,—stone crushing machinery.

Que., Montreal—O. Martineau & Fils, Ltd., 371 Marie Anne, E.—additional quarrying and stone crushing equipment.

Que., Quebec—Jobbin & Genois, Abraham Hill—machinery and equipment for proposed marble manufacturing plant at Riviere a Pierre.

Que., Quebec—Quebec Development Co., Union Bank Bldg.—stone crushing machinery.

Que., St. Moise—Tartague Lumber Co., Ltd., J. Dufort, Purch. Agt.—saw mill equipment; later, equipment for shingle mill and sash and door factory.

Que., Victoriaville—A. Le Houillier—complete sawmill equipment.

Metal Working Shops

Calif., Petaluma—Fuller & Peters, Main and Bridge Sts., plan to build a 50 x 112 ft. garage on North Main St. Architect not selected.

Calif., San Francisco — T. Hamill, 6140 Geary St., will build a 2 story automobile repair shop, etc., on Gear St. near Blake St. Estimated cost $10,500.

Calif., San Francisco—L. R. Lurie, Mills Bldg., awarded the contract for the construction of a 1 story machine shop on 10th and Minna Sts. Estimated cost $13,000. Noted Dec. 14.

Calif., Stockton—The H. Cowell Estate c/o W. H. George, Secy., 2 Market St., San Francisco, is having plans prepared for the construction of a 1 or 2 story, 80 x 100 x 150 ft. garage on Hunter and Channel Sts., here. Estimated cost $50,000. H. H. Meyers, Kohl Bldg., San Francisco, Archt.

Calif., Tulare—The Tulare Union High School District is having plans prepared for the construction of addition to auto mechanics building, also for remodeling and building additions to manual arts building. Estimated cost $22,000. Swartz & Ryland, Rowell Bldg., Fresno, Archts.

Conn., Bridgeport—The Lacey Mfg. Co., 50 Middle St., manufacturer of dies, tools, etc., plans to build a 2 story factory on Connecticut and Union Aves. Estimated cost $35,000. Architect not selected.

Conn., New Haven—The Eastern Machine Screw Co., Truman and Barclay Sts., awarded the contract for the construction of a 1 story, 30 x 30 ft. addition to its factory. Estimated cost $5,000.

Ill., Chicago—The Electrical Dealers Supply Co., 162 West Randolph St., is having plans prepared for the construction of a 3 story, 100 x 250 ft. factory on Diversey St. near Oakley Ave. Estimated cost $150,000. S. N. Crowen, 400 North Michigan Ave., Archt.

Ill., Chicago—The Yellow Cab Mfg. Co., 57 East 21st St., awarded the contract for the construction of a 1 story, 198 x 368 ft. cab assembling factory at 5801 Dickens Ave. Estimated cost $350,000.

Ill., Peoria—The Meyer Furnace Co., 1300 South Washington St., plans to rebuild its furnace factory, which was destroyed by fire. Estimated cost $100,000.

Ind., Fort Wayne—The Knuckle Valve Co., 825 Barr St., awarded the contract for the construction of a 1 story, 75 x 150 ft. valve factory. Estimated cost $26,000.

Ind., Indianapolis—The Amer. Can Co., 120 Bway., New York City, awarded the contract for the construction of a 4 story, 84 x 230 ft. can factory, here. Estimated cost $300,000.

Ind., Indianapolis—The Capitol & St. Clair Realty Co., c/o D. A. Bohlen & Son, Archts., 1001 Majestic Bldg., is having plans prepared for the construction of a 1 story, 112 x 122 ft. automobile service plant on North Capitol Ave. Estimated cost $27,000.

Ia., Denison — G. W. Newton plans to build a 2 story, 85 x 150 ft. garage on Main and Chestnut Sts. Estimated cost $40,000. Architect not announced.

Mass., Everett—The Sexton Can Co., 123 Broad St., Boston, awarded the contract for the construction of a 2 story, 50 x 130 ft. addition to its factory for the manufacture of cans on Cross St., here. Estimated cost $40,000.

Mass., Holyoke—D. O'Connell's Sons, 480 Hampden St., will build a 2 story, 110 x 120 ft. garage on Dwight St. Estimated cost $50,000.

Mass., Pittsfield—The Berkshire Products Corp. is having plans prepared for the construction of an electrical manufacturing plant. Cost between $70,000 and $100,000. G. Southerd, Jr., Genl. Mgr. J. M. Vance, 24 North St., Archt.

Mass., South Boston (Boston P. O.)—The Gillette Safety Razor Co., 41 West 1st St., plans to build an 8 story addition to its factory. Architect not announced.

Mass., Worcester—The Boulevard Park Associates, 339 Main St., awarded the contract for the construction of a 1 story, 45 x 165 ft. garage, etc., on Shrewsbury St. Estimated cost $40,000. J. F. Carberry, Agt.

Mich., Albion — The Service Caster & Truck Co., 316 East Porter St., will soon award the contract for the construction of a 1 story, 50 x 200 ft. factory for the manufacture of roller casters for trucks. Estimated cost $40,000. Private plans.

Mich., Detroit—The Michigan Stamping Co., 11631 Mack Ave., awarded the contract for the constructing of a 1 story, 140 x 347 ft. addition to its metal stamping plant. Noted Dec. 14.

Mich., Grand Rapids—The C. J. Litscher Electric Co., 41 Market Ave., plans to rebuild its 3 story, 60 x 130 ft. factory, which was destroyed by fire. Estimated cost $150,000. Architect not selected.

Mich., Muskegon Heights — The Piston Ring Co. is having plans prepared and will receive bids about February for the construction of a 1 story, 120 x 222 ft. foundry. Estimated cost $75,000. Private plans.

Minn., St. Paul—The L. W. Jordan Co., 118 West 7th St., plans to build a 2 story, 105 x 190 ft. garage and sales building. Estimated cost $65,000. Architect not announced.

N. J., Elizabeth—The Amer. Type Fdry. Co., Communipaw Ave., Jersey City, is having plans prepared for the construction of an administration building, 165 ft. long, and assembling plant, 600 ft. long, 1 and 2 story, on West Grand St., here. Estimated cost $750,000. Day & Zimmerman, 611 Chestnut St., Phila., Engrs.

N. J., Linden—The Layne—New York Co., subsidiary of Layne & Bowler Co., Chelsea Ave., Memphis, Tenn., manufacturer of pumps and screens, awarded the contract for the construction of a small factory, here.

N. Y., Buffalo—S. H. Horn, 217 Leroy Ave., plans to build a factory for the manufacture of automobile bodies at 488 Kensington Ave. Estimated cost $30,000. Architect not selected.

N. Y., Jamestown—The Jamestown Metal Desk Co., 104 Blackstone Ave., is having plans prepared for the construction of a 1 story, 100 x 200 ft. addition to its factory. Estimated cost $40,000. Beck & Tinkham, 317 Washington St., Archts.

N. Y., New York—The Pleasant Ave. Garage Corp., c/o Springsteen & Goldhammer, Archts., 32 Union Sq., will build a 1 story garage on 179th St. and 3rd Ave. Estimated cost $25,000.

N. Y., New York—S. Rubin, c/o C. Schaefer, Jr., Engr. and Archt., 394 East 150th St., will build a 1 story garage on Webster Ave. Estimated cost $45,000.

O., Alliance—The Alliance Machine Steel Castings Co. is having plans prepared for the construction of a 1 story, 75 x 600 ft. addition to its plant. Private plans.

O., Cleveland—The J. L. Free Co., 1040 Prospect Ave., (real estate), awarded the contract for the construction of a 1 story, 90 x 135 ft. sales room and garage at 3746 Prospect Ave. Estimated cost $50,000.

O., Cleveland — The National Screw & Tack Co., 2440 East 75th St., awarded steel contract for the construction of a 5 story, 56 x 165 ft. factory on Platt Ave. Estimated cost $250,000. Noted Nov. 2.

O., Norwood—The Ford Motor Co., Highland Park, Mich., awarded the contract for the construction of an assembling plant and loading platform for automobiles, here.

Pa., Erie — M. Griswold, c/o Griswold Mfg. Co., is receiving bids for the construction of a 2 story, 100 x 150 ft. garage on 20th and State Sts. Estimated cost $40,000. Private plans. Northwestern Motors Co., lessee.

Pa., Monessen—The Monessen Fdry. and Machine Co. awarded the contract for the construction of a 1 story, 32 x 100 ft. core room.

Pa., Phila.—Abbotts Dairy Co., 31st and Chestnut Sts., awarded the contract for the construction of a 3 story, 120 x 140 ft. garage on 3rd and Lombard Sts. Noted Dec. 21.

Pa., Pittsburgh—The Superior Auto Accessories Co., 1342 Forbes St., awarded the contract for the construction of a 1 story, 100 x 145 ft. and 78 x 120 ft. automobile show room and garage on Baum Blvd. and Woodworth St. Estimated cost $50,000.

Pa., Reading—The Biehl Auto & Wagon Wks., 31 South 5th St., is receiving bids for the construction of a 2 story, 85 x 200 ft. factory for the manufacture of automobile equipment. H. G. Mohn, Mohnton, Archt.

Pa., Uniontown—H. Cochrane, c/o H. W. Altman, Archt., Uniontown, is receiving bids for the construction of a 1 story, 90 x 120 ft. garage on Baum Blvd. Estimated cost $85,000.

Pa., Williamsport—The Glosser Motor Car Co., 248 William St., plans to build a 3 story, 43 x 66 ft. garage and automobile machine shop on William and West Church St. Estimated cost $50,000. S. A. and R. J. Glosser, owners.

R. I., Providence—The City Real Estate Co., 4 Weybosset St., is having plans prepared for the construction of a 2 story garage and service station, with capacity for 90 cars on Bway. and Westminster St. Estimated cost $50,000. Private plans.

R. I., Providence — The E. A. Smith Realty Corp., Weybosset St., plans to build a 3 story garage and service station, with capacity for 250 cars on Chapel St. Estimated cost $100,000. Architect not announced.

Tex., Amarillo—The U. & S. Zinc Corp. will soon receive bids for the construction of smelter, also industrial housing. Estimated cost $400,000. Private plans.

Tex., Dallas—The Dallas Gas Co., Logan St., is receiving bids and will open same about Jan. 1, for the construction of a 1 story, 60 x 150 ft. garage and workshop. Estimated cost $65,000. Private plans.

Wis., Cedarburg — The Hansen Canning Machine Corp., Port Washington, awarded the contract for the construction of a 1 story, 112 x 112 ft. factory, here. Estimated cost $40,000. Noted Dec. 7.

Wis., Janesville—J. A. Strimple, 219 East Milwaukee St., awarded the contract for the construction of a 2 story, 113 x 190 ft. garage, to replace the one which was destroyed by fire. Estimated cost $45,000.

Wis., Madison—The Capital City Garage Co., South Pinckney St., is having plans prepared for the construction of a 2 story, 66 x 165 ft. garage and repair shop on Washington St. Estimated cost $60,000. F. L. Kronenberg, Carroll Bldg., Archt.

Wis., Madison—L. F. Schoelkopf, 210 East Washington Ave., plans to build a 1 story, 66 x 150 ft. garage and automobile supply station on East Main St. Estimated cost $50,000. Architect not selected.

Wis., Madison—The University of Wisconsin awarded the contract for the construction of a 4 story, 62 x 68 ft. service station, including garage, electric substation, woodworking shop, etc., on University St. Estimated cost $85,000.

Wis., Madison—The Wisconsin State Hospital Comnrs. are having plans prepared for the construction of a 1 story, 45 x 124 ft. garage. Estimated cost $40,000. Dr. W. F. Lorenz, Mendota St., Secy. A. Peabody, Capitol Bldg., Archt.

Wis., Milwaukee—R. L. Clark, 2218 Meinecke Ave., is having plans prepared for the construction of a 2 story, 100 x 140 ft. garage on 20th St. Estimated cost $65,000. C. H. Tharinger, 3328 State St., Archt.

Wis., Milwaukee — The Harley-Davidson Motor Co., 3732 Chestnut St., awarded the contract for the construction of a 1 story, 80 x 145 ft. foundry. Estimated cost $45,000. Noted Dec.7.

Wis., Milwaukee — The Milwaukee Gas Specialty Co., 2017 Clybourn St., awarded the contract for the construction of a 1 story, 45 x 115 ft. addition to its factory. Estimated cost $45,000. Noted Dec. 7.

Wis., Milwaukee—The South Side Nash Co., 9th and Forest Home Aves., has had plans prepared for the construction of a 1 story, 72 x 93 ft. garage. Estimated cost $40,000. Gurda & Gurda, 2nd Ave. and Mitchell St., Archts.

Wis., Milwaukee—The Welch Investment Co., 105 Wells St., awarded the contract for the construction of a 2 story, 75 x 150 ft. addition to its garage on Grand Ave. Estimated cost $50,000. Noted Dec. 14.

Wis., Wausau—The Durant Motor Car Co., 208 Washington Ave., awarded the contract for the construction of a 2 story, 60 x 60 ft. garage. Estimated cost $40,000. Noted Dec. 7.

Ont., Toronto—C. Pearce, 100 Inglewood Dr., awarded the contract for the construction of a 1 story, 40 x 100 ft. garage on Bathurst St. Estimated cost $25,000.

General Manufacturing

Ala., Auburn—The Young Lumber Co. plans to rebuild the portion of its lumber mill, which was recently destroyed by fire. Estimated cost $30,000.

Calif., Oakland—The Art Rattan Wks., 475 Sutter St., awarded the contract for the construction of a 3 story factory on 24th Ave. near East 12th St. Estimated cost $15,000. Noted Dec. 14.

Calif., Oakland—The California Packing Corp., 101 California St., San Francisco, is receiving bids for the construction of a 1 and 2 story canning plant consisting of factory and warehouse, on 1st and Filbert Sts., here. P. Bush, 101 California St., San Francisco. Archt. Noted Nov. 16.

Calif., Petaluma—The Petaluma Ice & Cold Storage Co., branch of National Ice & Cold Storage Co., Postal Telegraph Bldg., San Francisco, has had plans prepared for the construction of a cold storage plant, here. Estimated cost, including equipment, $100,000. Private plans.

Calif., Riverbank—C. L. Flack, 1st Natl. Bank Bldg., is interested in a company which is being organized to build a cannery on a 100 x 400 ft. site. Estimated cost $15,000. Architect not selected.

Calif., Sacramento—The Bd. Educ. will receive bids until Jan. 15 for the construction of 4 buildings, comprising gymnasium, domestic science, shops and cafeteria, on 34th St. Estimated cost $540,000. E. A. Matthews, Call Bldg., San Francisco, Archt.

Calif., San Francisco—The California Shade Cloth Co., Inc, 2183 Bryant St., will build a 2 story shade cloth factory on San Bruno Ave. Noted Dec. 21.

Calif., San Francisco—Roth, Winter & Walsh, 1271 Mission St., awarded the contract for the construction of a 2 story, 91 x 120 ft. packing plant on Townsend St. Estimated cost $75,000. Noted Dec. 21.

Calif., San Jose—The De-Hi Food Products Co. plans to build a dehydrating plant on a 5 acre site on Union Ave. A. P. Marston, c/o California Prune and Apricot Growers, San Antonio and Market Sts., Pres. Architect not selected.

Calif., Stockton — The Terminal Cold Storage and Warehouse Co., c/o N. E. MacLean, Archt., 16 California St., San Francisco, is having plans prepared for the construction of a pre-cooling plant on Main Channel and Mormon Slough, here. Estimated cost $260,000.

Conn., Waterbury—The Waterbury Gas Light Co., 83 Center St., will build a 1 story, 40 x 240 ft. addition to its plant on South Leonard St. Estimated cost $33,000.

Ill., Peru — V. A. Matteson, Archt., 8 South Dearborn St., Chicago, is receiving bids for the construction of a 2 story factory to contain 715,000 cu.ft. for the Western Clock Co., here. Estimated cost $250,000.

Ind., Cannelton — The Cannelton Sewer Pipe Co. plans to build a 4 story, 62 x 208 ft. clay plant, including 8 kilns, radial stack, power plant, etc. Estimated cost $240,000. Private plans.

Ind., Evansville—The Evansville Packing Co., Morgan Ave., is having plans prepared for the construction of a 3 story, 31 x 42 ft. packing plant. Estimated cost $45,000. H. E. Boyle & Co., Furniture Bldg., Archts.

Ind., Evansville—B. W. Jenkins, 522 South 4th Ave., is having plans prepared for the construction of a 1 story, 40 x 100 ft. packing plant. Estimated cost $26 000. H. E. Boyle & Co., Furniture Bldg., Archts.

Ind., Fort Wayne—The Fort Wayne Box Co., Calhoun and Superior Sts., plans to build a box factory. Estimated cost $100,000. Architect not announced.

Ind., Indianapolis — The Amer. Tent & Awning Co., 632 South East St., awarded the contract for the construction of a 2 story, 72 x 112 ft. addition to its awning factory. Estimated cost $26,000.

Ind., Indianapolis — The Indianapolis Glove Co., Liberty and Michigan Sts., is having plans prepared for the construction of a 5 story, 100 x 160 ft. glove factory. Estimated cost $225,000. Rubush & Hunter, Amer. Central Life Bldg., Archts.

Ind., Indianapolis—The Kramer Realty Co., 315 North Garfield Ave., is having plans prepared for the construction of a 1 story, 80 x 240 ft. furniture factory, including 10 car garage and dry kiln, on English Ave. Estimated cost $35,000. R. N. Edwards, Union Trust Bldg., Engr.

Ind., Shelbyville—The Kennedy Paper Bag Co. is having plans prepared for the construction of a 1 story, 60 x 219 ft. paper bag factory. Estimated cost $27,000. Rubush & Hunter, Amer. Central Life Bldg., Indianapolis, Archts.

Ind., Sheridan—The Indiana Condensed Milk Co., 220 North Pennsylvania St., Indianapolis, is having plans prepared for the construction of a 2 story addition to its milk plant, here. Estimated cost $26,000. Private plans.

Ia., Dubuque—T. J. Mulgrew, Jones and Iona Sts., awarded the contract for the construction of an artificial ice and cold storage plant. Estimated cost $75,000.

Ia., Iowa City—The Economy Advertising Co. has purchased a site and plans to build a 2 or 3 story printing plant. Estimated cost $75,000. B. W. Mercer, Pres.

Ky., Louisville—The J. F. Kurfees Paint Co., 201 East Market St., plans to build a 5 story, 61 x 204 ft. addition to its plant. Estimated cost $200,000. Architect not announced.

Mass., Gardner — The Nichols Rattan Products Co., Main St., plans to build a 2 story, 90 x 140 ft. factory for the manufacture of chairs. Estimated cost $75,000. Private plans.

Mass., Gardner—The Standard Specialty Wks., Union St., will build a 1 story, 40 x 100 ft. factory for the manufacture of specialties. Estimated cost $25,000.

Mass., Medford—The Amer. Woolen Co., 245 State St., Boston, awarded the contract for the construction of a 5 story, 60 x 120 ft. addition to its factory on Boston Ave., here. Estimated cost $100,000.

Mass., South Hadley — The Holyoke Gummed Products Co., 9 Suffolk St., Holyoke, awarded the contract for the construction of a 1 story, 140 x 147 ft. gummed paper factory, here. Estimated cost $40,000.

Mass., Springfield—The Springfield Dairy System, 70 Ventura St., plans to build a bottling plant. Estimated cost $90,000. C. J. Grant, Clk.

Mass., Watertown—Vose & Sons Piano Co., 1010 Massachusetts Ave., Roxbury (Boston P. O.), awarded the contract for the construction of a 5 story, 80 x 220 ft. piano factory on School, Arsenal and North Beacon Sts., here. Estimated cost $300,000. Noted Oct. 19.

Mich., Grand Rapids — H. H. Turner, Archt., 923 Michigan Trust Bldg., is receiving bids until Jan. 10 for the construction of a 2 and 3 story, 85 x 178 ft. Junior High School, including manual training department, on Lee St., for the Bd. Educ. Estimated cost $150,000. H. Morrill, Business Mgr. Bd. Educ., City Hall.

N. J., Trenton—H. Entine, 163 Fair St., awarded the contract for the construction of a 2 story, 60 x 60 ft. burlap factory. Estimated cost $15,000.

N. Y., Jamaica—The Edward Langer Printing Co., Inc., awarded the contract for the construction of a 5 story, 120 x 280 ft. printing plant.

N. C., Charlotte—The H. M. Wade Mfg. Co., South Graham St., manufacturer of show cases and fixtures, is having plans prepared for the construction of a 4 story, 120 x 150 ft. factory. Estimated cost $150,000. Lockwood, Greene & Co., Piedmont Bldg., Archts.

N. C., Gastonia—The Ragan Spinning Co. plans to build a 10,000 spindle cotton mill. G. W. Ragan, Pres.

N. C., New Bern—The Rowland Lumber Co. plans to rebuild its mill which was recently destroyed by fire. Estimated cost $200,000. A. R. Turnbull, Pres.

O., Akron—The Miller Rubber Co., South High St., awarded the contract for the construction of 1 story, 75 x 125 ft. and 40 x 42 ft. factory buildings for the manufacture of rubber tires. Estimated cost $20,300.

O., Akron—W. Williams, 101-111 North High St., awarded the contract for the construction of a 2 story, 67 x 133 ft. soft drink bottling plant. Estimated cost $10,000.

O., Cleveland—The Peerless Paper Box Co., 3225 East 55th St., has had plans prepared for the construction of a 1 story, 59 x 140 ft. factory and warehouse at 3221 East 56th St. Estimated cost $40 000. P. Matzinger & Co., Caxton Bldg., Archts.

O., Cleveland—H. E. Roth, 1604 East 117th St., awarded the contract for the construction of a 1 story, 50 x 100 and 30 x 40 ft. hide house and garage on West 65th St. Estimated cost $40,000. Noted Dec. 14.

O., Lakewood (Cleveland P. O.) — The Cleveland Waterproof Paper Co., c/o A. Kennedy, Mgr., 2033 West 106th St., Cleveland, awarded the contract for the construction of a 1 story, 40 x 160 ft. factory, on Berea and Fischer Rds., here. Estimated cost $40,000.

O., Norwood (Cincinnati P. O.) — The Kemper-Thomas Co., Park Ave., manufacturer of calendars and advertising novelties, is having plans prepared for the construction of a 2 story, 60 x 200 ft. factory. Estimated cost $150,000. S. Hannaford & Sons, 1024 Dixie Terminal Bldg., Cincinnati, Archts.

Ore., Portland—The Port of Portland will soon receive bids for the construction of a hydro-cyanic acid fumigating plant, to fumigate cotton in bales, sacking, jute, plants, and other imported materials. Estimated cost $10,000. G. B. Hegardt, foot of Stark St., Ch. Engr.

Pa., Abington—Tilden & Register, Archts., 1525 Locust St., Phila., are receiving bids for the construction of a 2 story, 29 x 66 ft. heating plant and laundry, here, for the Abington Memorial Hospital, c/o J. B. Winder, Abington. Estimated cost $75,000.

Pa., Mount Jewett—The Safety Sled Co. plans to rebuild its factory which was recently destroyed by fire. Estimated cost $50,000. Architect not announced.

Pa., Phila.—The Crescent Textile & Supply Co., c/o W. Caldwell, Trenton and Susquehanna Aves., will soon receive bids for the construction of a 4 story card and textile factory on Trenton Ave. Estimated cost $100,000. W. H. Wooters, 816 West Allegheny Ave., Archt.

Pa., Phila.—The Pennsylvania Brick & Tile Co., c/o L. F. Ducker, Land Title Bldg., awarded the contract for the construction of a 1 and 2 story plant, capacity 150,000 brick per day, on Westmoreland St. and Delaware Ave. Estimated cost $100,000.

Pa., Phila.—S. F. Whitman & Sons, 4th and Race Sts., are having plans prepared for the construction of a 5 story candy factory. Estimated cost $250,000. W. Steele & Sons, 16th and Arch Sts., Archts.

Pa., Pittsburgh—J. M. McCollum, Archt., Berger Bldg., is receiving bids for the construction of a 3 story, 23 x 50 ft. publishing plant on 2nd Ave. and Grant St. for Smith Bros., Inc., 409 Grant St.

Pa., Pittsburgh—The Vitro Mfg. Co., 720 Bessemer Bldg., is having plans prepared for the construction of a 1 story, 32 x 45 ft. chemical factory at 600 Cliff St. Estimated cost $5,000. P. R. L. Hogner, 5th Ave. and 11th St., New Kensington, Archt.

Pa., Union City—A. L. Calfisch & Son Lumber Co. plans to rebuild portion of its saw mill which was destroyed by fire. Estimated cost $5,000. Architect not announced.

Pa., Warren—The Crew-Levick Co. plans to rebuild its oil filter plant, which was destroyed by fire. Estimated cost $40,000. Architect not announced.

Pa., Washington — Topliffe & Ely Co., manufacturer of toys, awarded the contract for the construction of a 3 story, 20 x 80 ft. factory on West End St. Estimated cost $100,000.

Tex., Pioneer—The Amer. Oil Co. plans to build a refinery, capacity 2,500 bbl. T. Ryan, Pres. Architect not announced.

Wash., Vancouver—U. McDonald, 315 Falling Bldg., Portland, Ore., Supt. of Western Lumber & Door Co., is building a planing mill, here. Estimated cost $50,000.

W. Va., Fairmont—The Imperial Ice Cream Co., Clarksburg, is having plans prepared for the construction of a 1 story, 50 x 120 ft. ice cream factory, including a 15 ton ice plant, on 5th St. and Virginia Ave., here. Estimated cost $15,000. Private plans.

Wis., Green Bay—The Press Gazette, 315 Cherry St., plans to build a 3 or 4 story plant. Estimated cost $100,000. Architect not selected.

Wis., Madison—The Madison Supply Co., 615 East Washington Ave., awarded the contract for the construction of a 2 story, 50 x 60 ft. bottling works and warehouse building. Noted Dec. 14.

Wis., Menasha—The John Strange Paper Pail Co. will build a 4 story, 60 x 100 ft. factory for the manufacture of paper pails. Estimated cost $50,000. J. Strange, Pres.

B. C., Prince George—The Aleza Lake Sawmill Co. plans to build a sawmill. Estimated cost $20,000. Architect not announced.

Ont., Hamilton—The Ontario Shale Brick Co., Sun Life Bldg., plans to build a plant. Estimated cost $100,000.

Ont., Petrolea — The Canadian Oil Co. plans to rebuild its plant which was partially destroyed by fire. Estimated cost $35,000. C. A. Hale, Mgr.

American Machinist

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American Machinist

KENNETH H. CONDIT and FRED H. COLVIN, *Editors*
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How Black & Decker Drills Are Made—S. A. Hand
Tool Engineering—Albert A. Dowd and Frank W. Curtis
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JAMES H. McGRAW, President — ARTHUR J. BALDWIN, Vice-President — MALCOLM MUIR, Vice-President — EDWARD D. CONKLIN, Vice-President — JAMES H. McGRAW, JR., Secretary and Treasurer

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A good reason!

In many countries of the old world things are done in direct contrast to the way they are done in America. Take road making for example. Hundreds of natives can work on a small stretch of road all day, using small toylike shovels, without making more than a mere "scratch on the surface."

However, you cannot blame them. They just don't know better. They are pursuing methods used by their ancestors and it appears that their line of reasoning is that their forefathers did the work that way and, therefore, they should do likewise. Over there labor is cheap and time plentiful. Why should they hurry and get the job done quickly?

In comparison, think of the modern steam shovel and methods of doing such work in this country. Think how orderly and quickly such jobs are accomplished. This isn't just because of the American idea to get things done in a hurry. It is because over here *TIME means MONEY*.

It does not matter what kind of work you are doing, the quicker you get it done the lower the cost will be. Take lathe work for instance. If you have lots of parts to machine why do them on an ordinary engine lathe? It is true our ancestors did the work that way, but times have changed!

The idea is to get the work done, holding in mind the ever-present fact that the less time it takes, the lower the cost per piece will be.

There is a lathe on the market that can do duplicate work with a time-saving of 25 to 75 per cent as compared to the ordinary engine lathe and yet it retains its value as a general purpose tool.

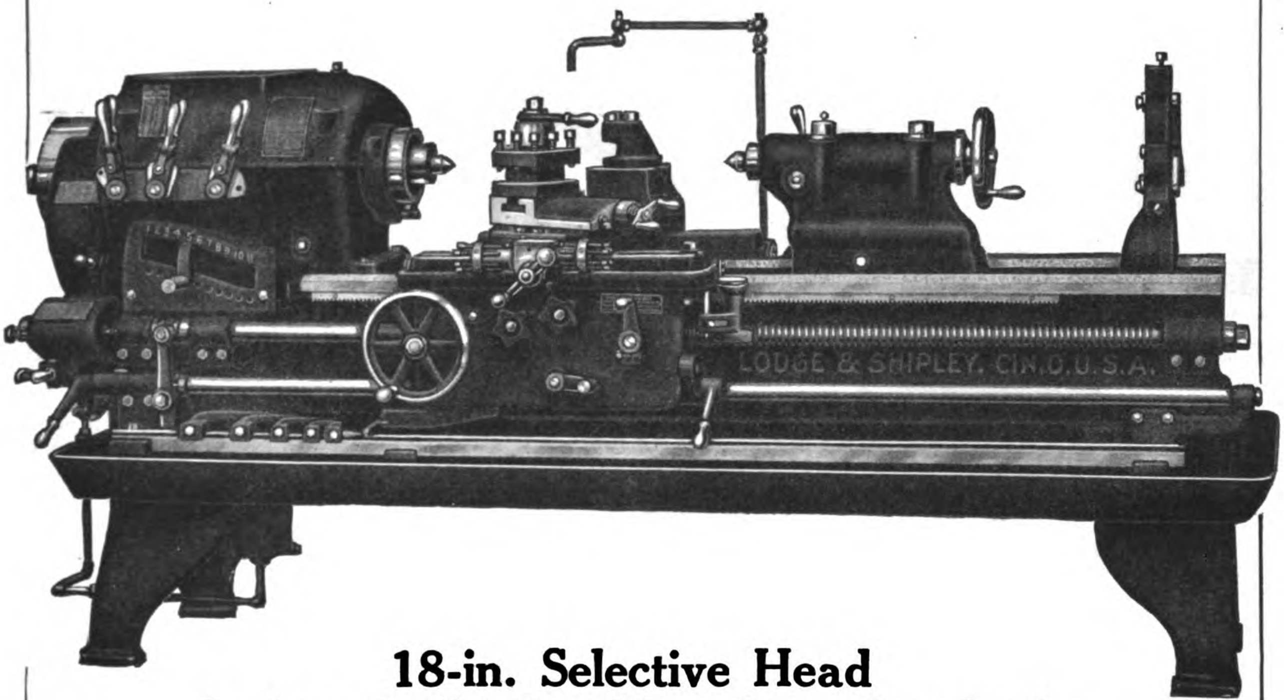
Look at the picture of it on the opposite page.

The Lodge & Shipley

Cincinnati,

LATHES

Good Lathes Only



18-in. Selective Head
Lodge & Shipley Manufacturing Lathe

Equipment includes Connected Compound and Plain Rests, Pan, Pump and Tubing; Multiple Length and Diameter Stops; Four-way and High Duty Tool Blocks. Made in sizes 14 to 30 in.

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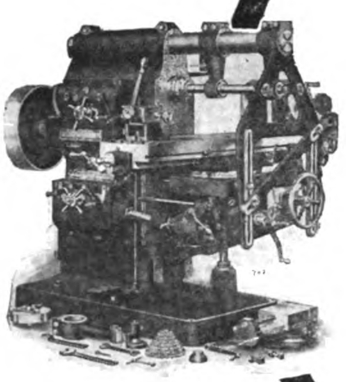


Good design in a vital spot—

—The main spindle bearing of the Cincinnati Milling Machine

The box machined, inside and out, with three circumferential dovetail grooves, on the inside.

Showing the axial dovetail grooves.

The main spindle bearing is the very heart of the miller. We recognized this when we developed our special design many years ago.

Because of its proved excellence we are using it today.

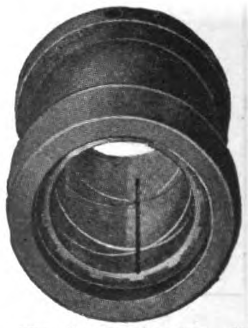
It consists of a cast-iron box with a special composition lining, composed of 90% tin and no lead. But its value is not entirely in this unusual material. The way we make it has much to do with its success.

The bearing metal cast in place.

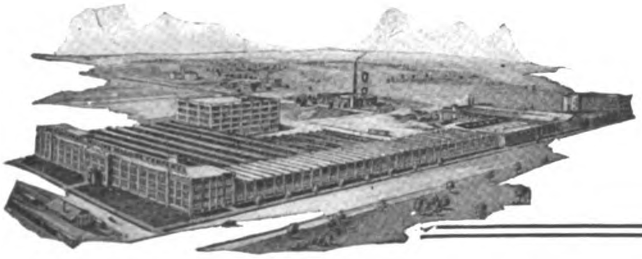
This bearing has proved so very satisfactory that we believe it to be unsurpassed.

We submit it as another example of Cincinnati Miller excellence.

The bearing metal thoroughly compressed and forced into the grooves, rendering it dense and homogenous. It becomes an integral part of the cast-iron box and will not work loose.

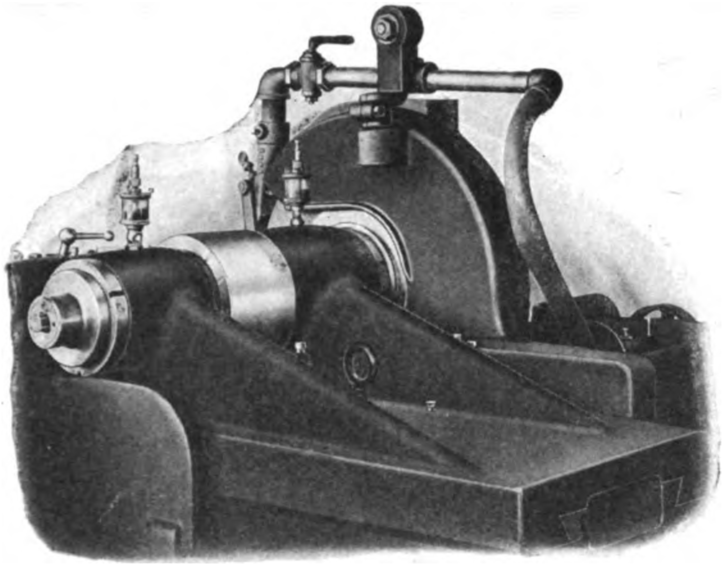


The finished bearing. It is bored, accurately reamed, oil-grooved and then ground on the outside concentric with the bearing.

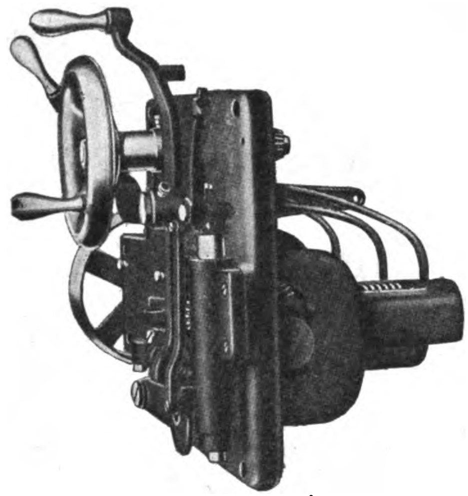


The Cincinnati Milling Machine Co.

Cincinnati, O.

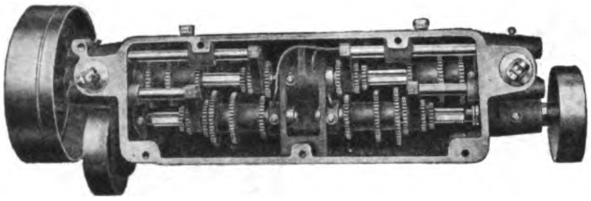


Wheel Head Unit



Reverse Plate Unit

Each unit of the Cincinnati Plain Grinder must function perfectly—



Speed Change Box Unit

before the final assembly of the complete machine. The various mechanisms, built and assembled as individual units, are thoroughly tested out before this final assembly.

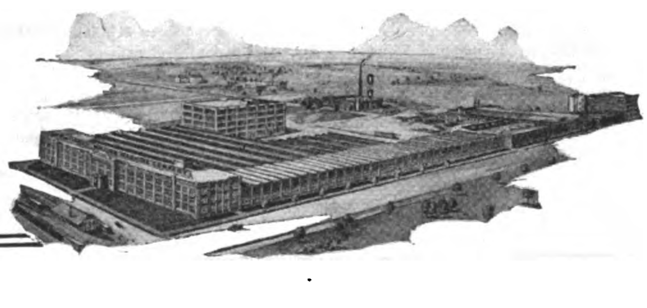
The unit system of manufacture permits of free accessibility for adjustments and repairs; eliminates individual fitting in the assembling of the machine and insures interchangeability of parts.

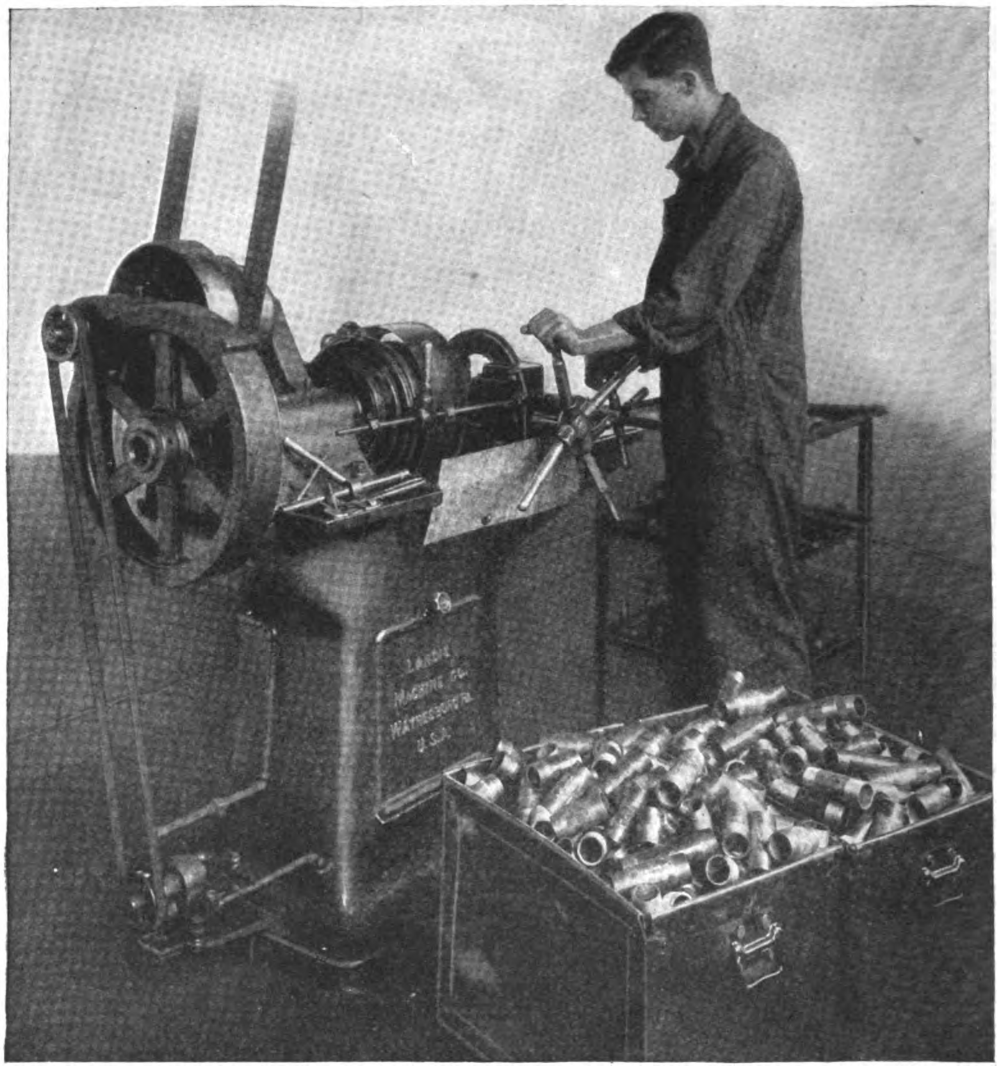
This is but one of the many admirable features of this modern grinding machine. It is massive, rigid, generously proportioned and powerful. Its control is centralized. These combined elements effect accurate and economical production.

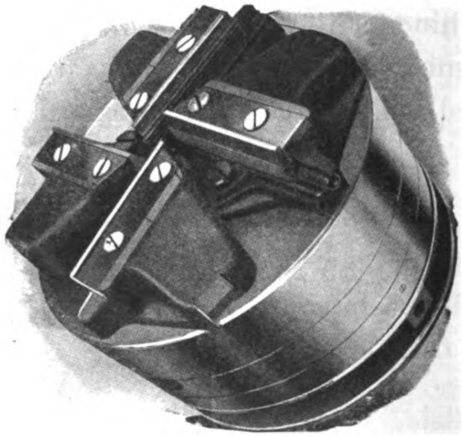
The immense plant and unlimited facilities of the Cincinnati Milling Machine Company stand behind this machine.

The Cincinnati Grinder Company

Cincinnati, O.

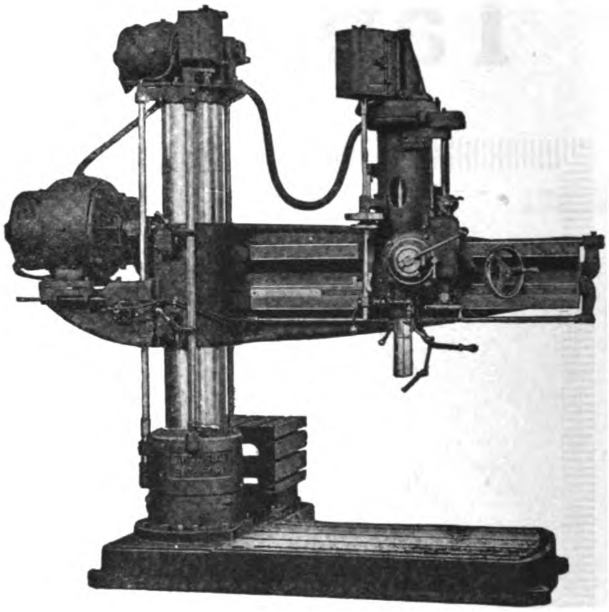






THE CINCINNATI BICKFORD

A Type of Drive That Some Prefer



There is a good deal to be said for this method of drive—mounting the motor on the arm.

It eliminates four shafts and seven gears, thereby obtaining direct power transmission to the spindle. This makes for simplicity, smooth operation and power economy.

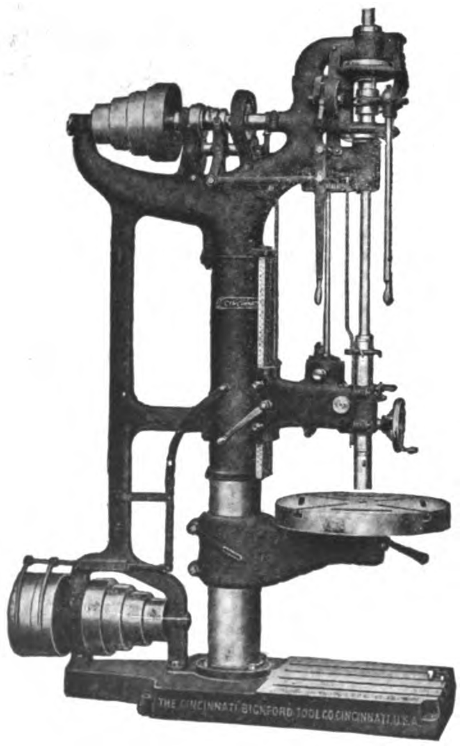
The motor at the top of the column renders the elevating mechanism entirely independent of the drive—the great advantage of which is explained in a new twelve-paged circular devoted exclusively to Motor Driven Radial Drills.

These drills are all that an experience of 48 years can make them—thoroughly up to date in design and reliable to the last degree in construction

The Cincinnati Bickford Tool Co.

Oakley, Cincinnati, Ohio, U. S. A.

Founded 1874



THE CINCINNATI

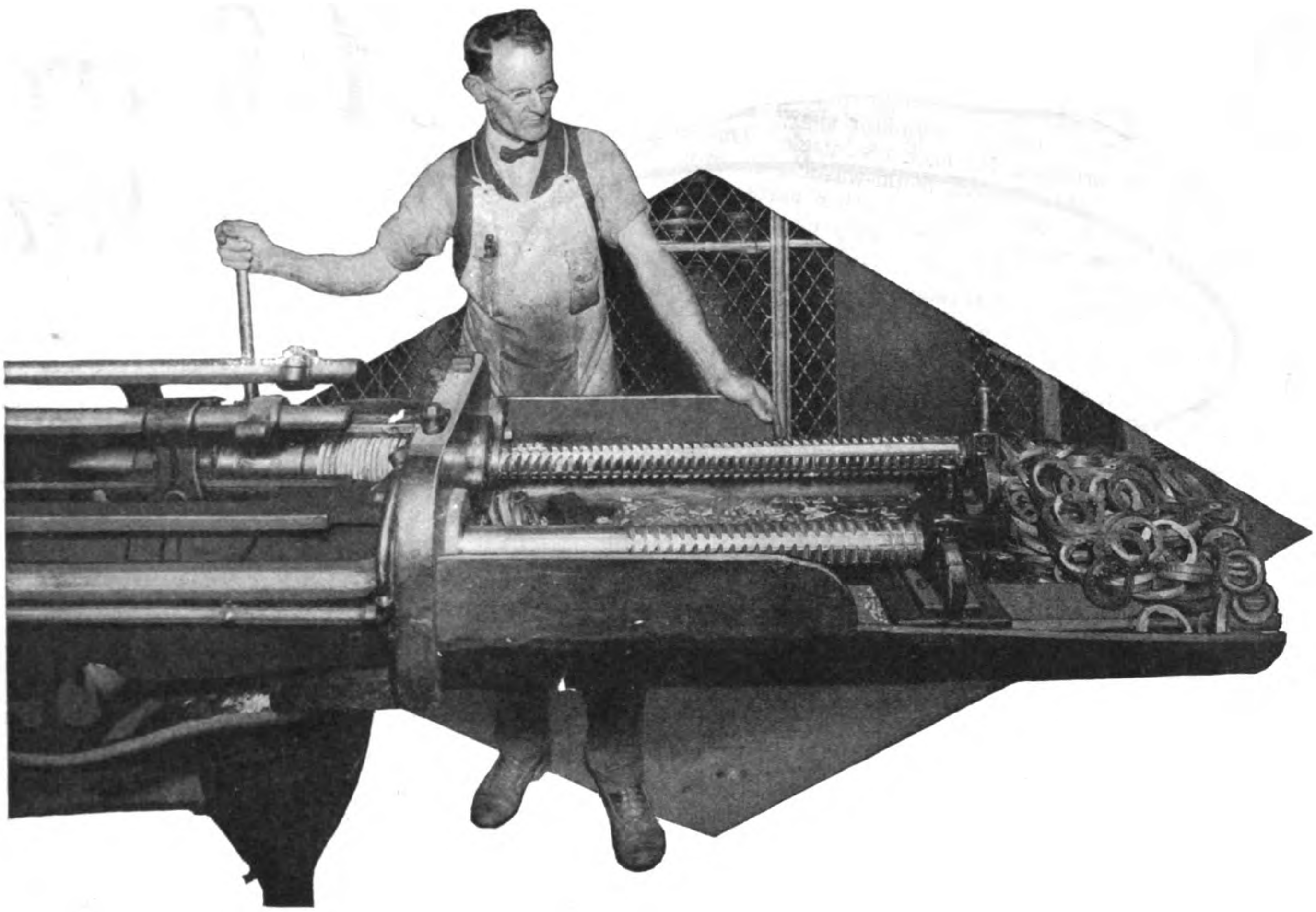
Economy of the Tapping Attachment

Besides eliminating the expense and inaccuracy of tapping by hand, the Tapping Attachment effects a great saving in taps by reducing the breakage and prolonging the life of their cutting edges It also provides a convenient means for starting and stopping the spindle when changing tools

The Tapping Attachment acts through friction clutches and is hence operative at all speeds without shock or noise It has unusual gripping power, is adjustable for wear and may be disengaged when not required for tapping

We make this type of drill in eight styles and five sizes, ranging from 24 to 42 inches

No. 4



1000 fibre timer rings broached per hour—4 slots per ring

Here is a view of the business and of the J. N. Lapointe Co. Double Head Broaching Machine in the plant of the American Vulcanized Fibre Co., of Wilmington, Del.

The machine is broaching slots for timer contacts in fibre timer rings. Four slots are broached in each ring at one pull of the broach. The size of each slot is 5-8 x 5-16 x 3-8 in. and limits of accuracy are —.003 in. The Double Head makes possible the unusually fine production of an average of 1,000 completely broached rings per hour.

The American Vulcanized Fibre Co. states that the J. N. Lapointe Co. machine "answers our purpose in every respect."

In all work in the broaching field the J. N. Lapointe Co. machines will be found to answer the purpose in every respect.

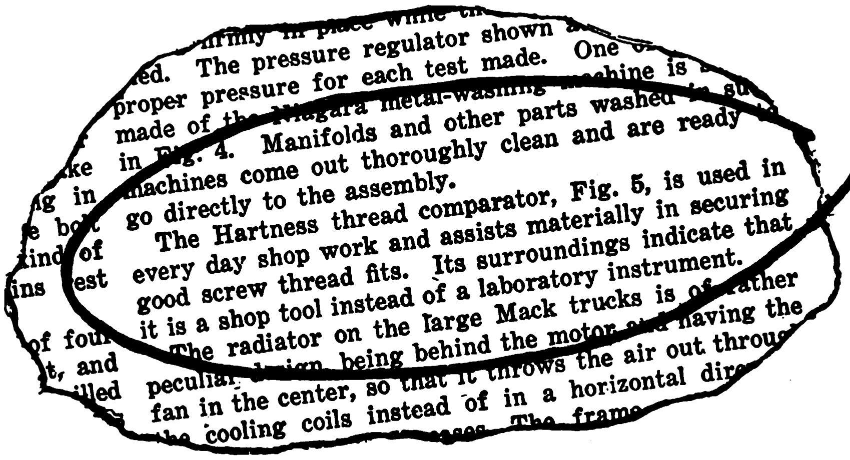
They are made in five sizes that will handle the smallest and the largest work that is practical in the broaching line. These machines have exclusive features that make them preeminent in the broaching field for big production of accurate work.

Let us tell you in detail about these exclusive features and what they would mean to you on your broaching work.

Your request for information or catalog will receive prompt attention. Write today.

BROACHING EQUIPMENT
THE J.N. LAPOINTE CO
NEW LONDON
CONN
MACHINES AND TOOLS

A Sturdy Not a


...ed. The pressure regulator shown
proper pressure for each test made. One
made of the Niagara metal-washing machine is
in Fig. 4. Manifolds and other parts washed
machines come out thoroughly clean and are ready
go directly to the assembly.
The Hartness thread comparator, Fig. 5, is used in
every day shop work and assists materially in securing
good screw thread fits. Its surroundings indicate that
it is a shop tool instead of a laboratory instrument.
The radiator on the large Mack trucks is of rather
peculiar design, being behind the motor and having the
fan in the center, so that it throws the air out throu...
cooling coils instead of in a horizontal dir...

This clipping and the cut of the machine below are taken from an article appearing on page 846 of the June 8th issue of the *American Machinist*, entitled "Miscellaneous Operations on the Mack Truck."

The article tells about some of the apparatus used in the commercial manufacture of this famous truck.

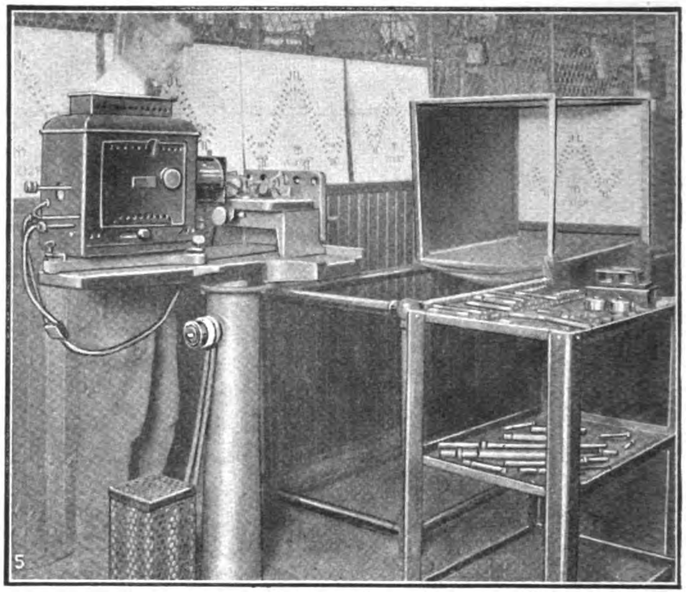
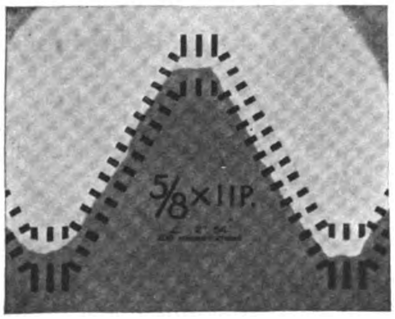


Fig. 5. Using Thread Comparator in the Shops of The International Motor Company



The illustration, to the left, gives a clearer view of the tolerance chart with the highly magnified silhouette of the screw thread upon it that the operator SEES when using the Comparator. Just look at this chart for a minute and *see* how easy it is to tell exactly what and where your screw thread troubles are. You can readily see that this particular screw is not acceptable because of the lead error, which is clearly outside the tolerance limits. The whole story is there at a glance.

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Jones & Lamson

Springfield,

Shop Production Tool—Laboratory Instrument

The Hartness Screw Thread Comparator is designed to be used day in and day out like any other shop tool

If there is any doubt in your mind as to the productive capacity of the Hartness Comparator this example from the busy shops of The International Motor Company should dispel it. We can furnish you with many more, equally as convincing examples, from many different industries where good screw threads are cut on a commercial basis.

There is no question of the superiority of the Hartness *visual method* of screw thread inspection. It is the modern way. It not only is superior to the ring gage method in that it tells its story to the eye but it is also ten times as fast.

When once you see the Comparator in operation on a production basis you cannot fail to appreciate that it is the most thorough, the surest, the quickest and the most economical method of inspecting screw threads that is available today for the small or large shop.

And here's another thought; the Comparator will greatly improve the accuracy and quality of your screw thread output for when you can *see* clearly what and where your thread troubles are you can quickly end them.

Let us give you all the details of this machine and what it will mean to you in your manufacture of screw threads. Just drop us a line right now.

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Luevehaven, Wz., 153 Rotterdam
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"Quick as a cat on feed changes"

AMERICAN HIGH

The tremendous power and speed of "AMERICAN" High Duty Lathes have attracted so much attention that folks sometimes overlook other features whose superiority is equally pronounced.

One of these is CONVENIENCE or handy control—and it's a feature that means a great deal to the operator of this 24-inch "AMERICAN" in the A. B. See Elevator plant, Jersey City. In the class of work ticketed for this lathe (especially motor parts) speed and feed changes are a big factor.

"No time lost changing gears," says the operator, "just a shift of the lever and the thread or feed is ready—all in less than five seconds. And the same thing for speed changes or quick reverse."

AMERICAN

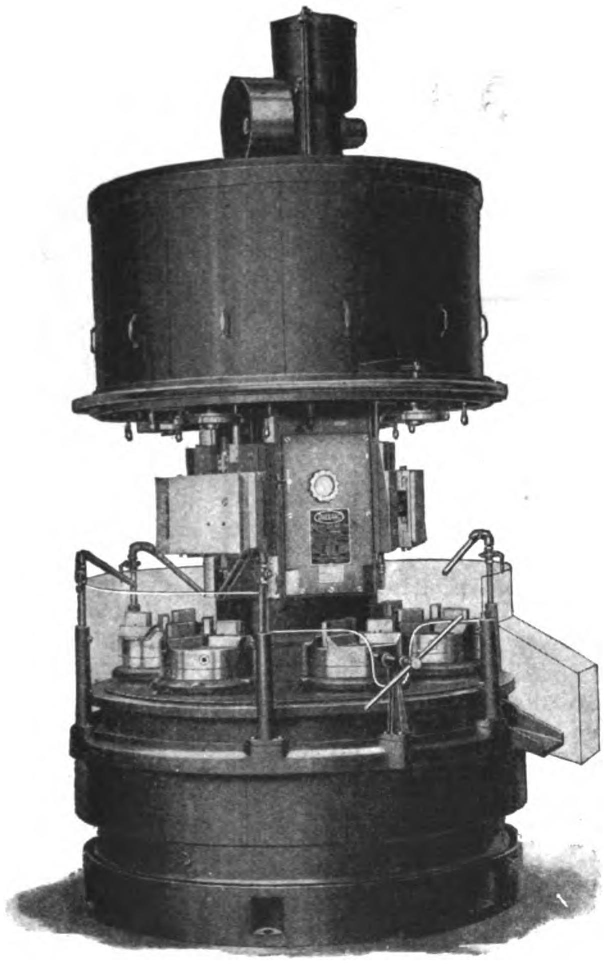
The American Tool Works Co.,
Lathes, Planers,

It Repays Its Own Cost in a Few Months—

The

BULLARD

MULT-AU-MATIC



Operating costs lower with the entry of the Mult-Au-Matic in your machining operations. We can cite scores of instances wherein it has paid its own cost within a few months.

On a flywheel job the savings made by the Mult-Au-Matic was sufficient to absorb the total investment in sixteen months.

In another case a Motor End Shield was processed through several machines for consecutive operations. The saving in cost effected by Mult-Au-Matic Methods wiped off the total investment charges in seven months and a few days.

An installation of two Mult-Au-Matics was paid for from savings in fourteen months.

These savings are readily accounted for—you save on man power, on machine costs, you save minutes and floor space.

Ask our engineers how Mult-Au-Matic performance will affect costs in your plant.

BULLARD

Bridgeport, Connecticut

Clutch Bodies	**Universal Joint Housings**	**Sheaves and Pulleys**
Small Motor Bodies	**Flywheels, Gear Blanks**	**Brake Spiders**
Motor End Shields	**Differential Gear Cases**	**Shaft Flanges**
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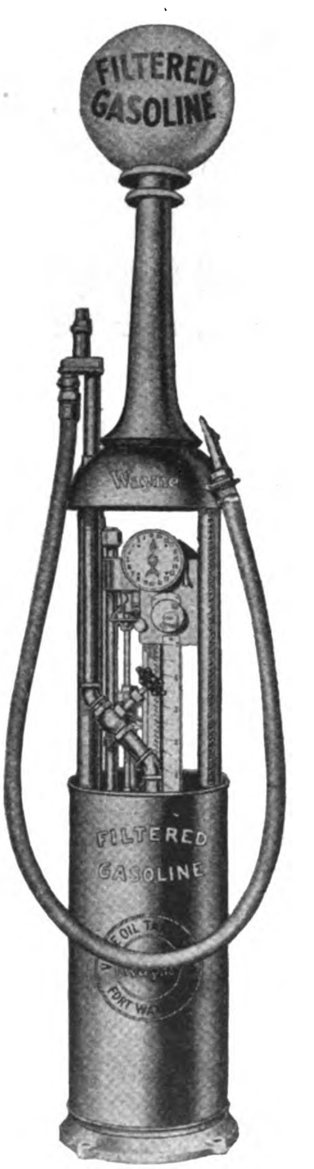
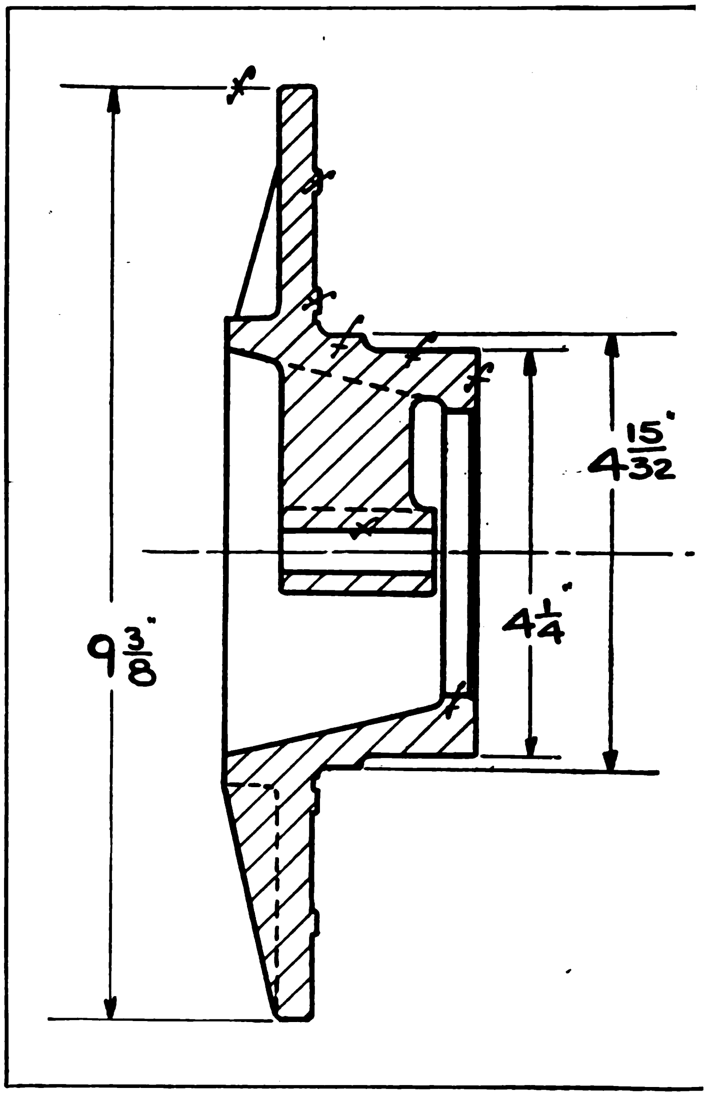
For Quality



The Gasoline Pump illustrated on this page is the product of the Wayne Oil Tank & Pump Co., of Fort Wayne, Indiana.

Parts for this pump are machined on Potter & Johnston Automatics. In this particular case the operations are on a Plunger Bottom, Turning, Boring, Facing, Chamfering and Finishing the hole.

Work of this nature requires the attention of the operator only a portion of the time, consequently enabling him to attend a battery of machines.



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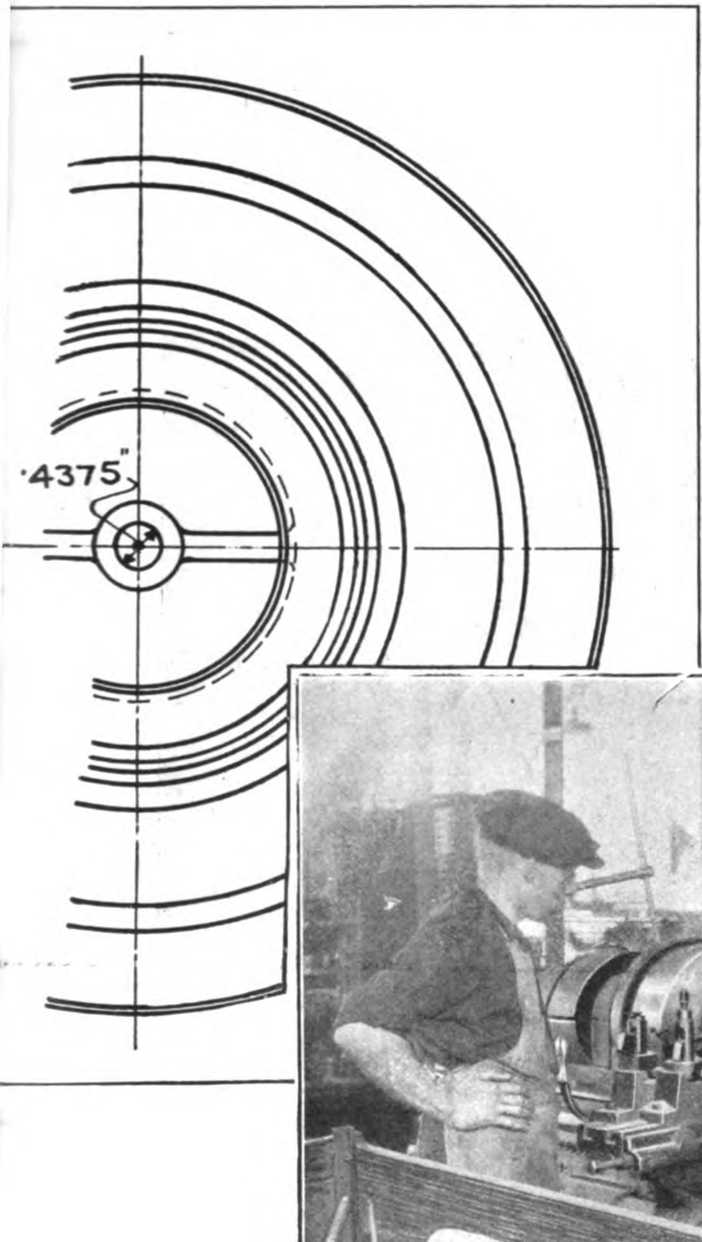
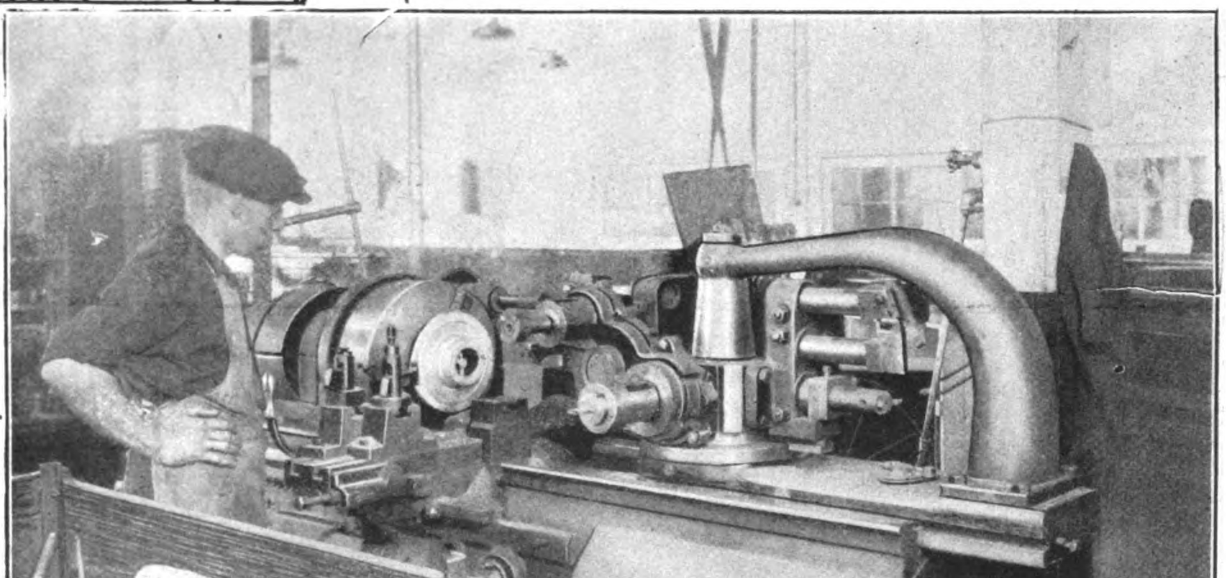
and For Speed



The High Speed Drilling Attachment allows the use of proper speeds for the machining of the 7/16-in. hole, and the larger diameters simultaneously. This ensures production without endangering the high standard of quality demanded by the Wayne Oil Tank & Pump Co.

Send your samples or drawings to us, and we will tell you what P. & J. can do for you.



Holding to 0.0005 in limits on

No better example of the range and scope of the Heald No. 70 can be found than at the plant of the Hart Roller Bearing Company of West Orange, N. J. One particular job of unusual interest is the grinding of the outside race for a Dynamometer bearing used for brake testing oil engines of the Deisel Type.

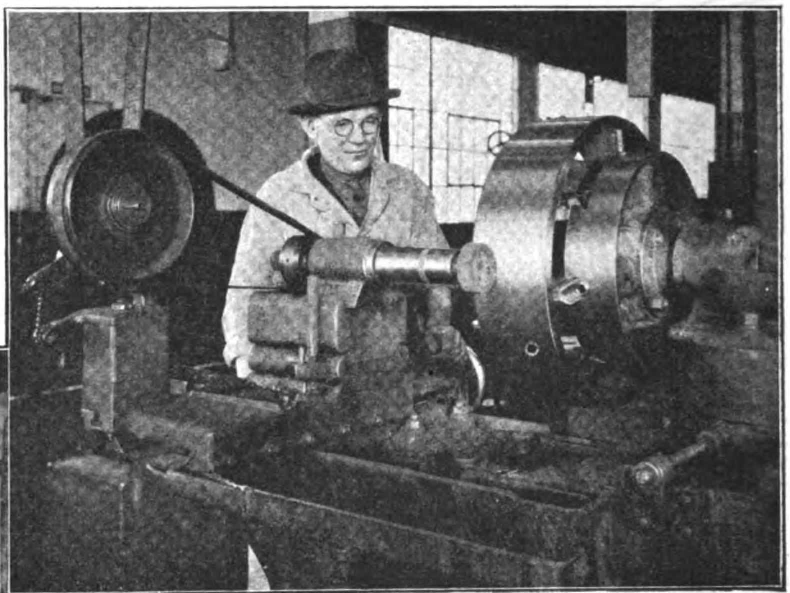
These races measure 21½ in. outside diameter and are tested to 600 Brinnell Hardness Test. Both inside and outside surfaces are ground on this race and tolerance limits are held to plus or minus .0005 in. The width across the face of this race is 5.687 in.

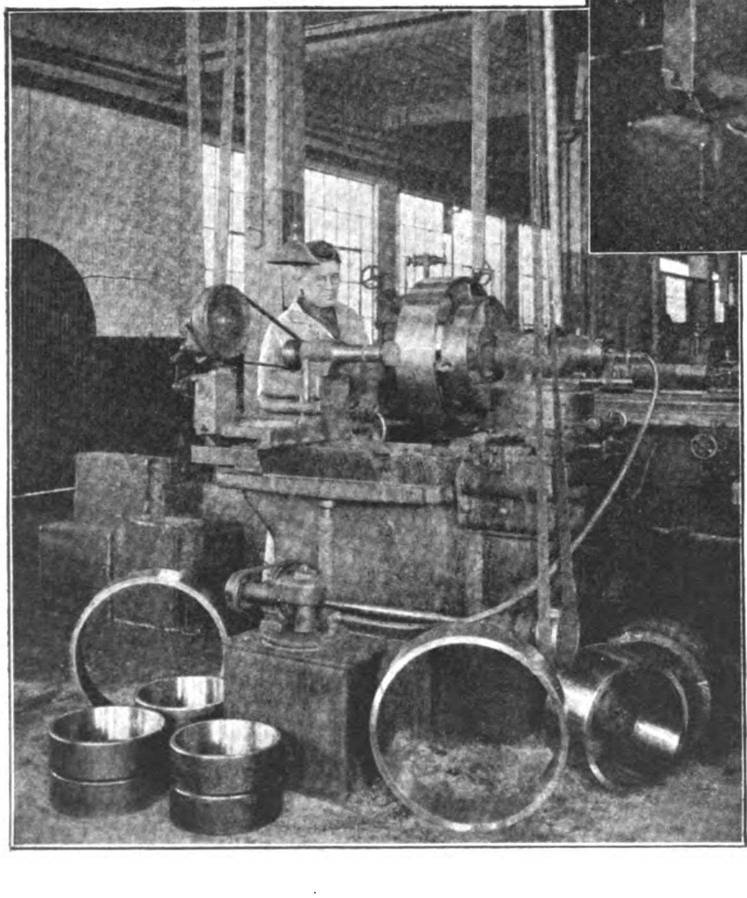
The dimensions for the inside race, also ground on the Heald are 15.570 in. outside and 13.875 in. inside. The same tolerance limits are held to in all operations.

Grind with a

HEALD

and be sure





Mr. C. W. Chisholm, General Manager of the Hart Roller Bearing Company, states that with his Healds he can efficiently grind roller bearing races from ¾ in. to 21½ in. diameter and that the same accuracy and finish is obtainable regardless of the size. A glance at the picture on the left will give you an idea of how large these bearings are.

a 21½ in. high carbon steel race

The Heald No. 70 Grinding Machine is a manufacturing unit in every sense of the word. It grinds absolutely round holes straight or tapered in bushings, cylinders, gears, gauges, cones, etc.

It is as rigid and massive a machine as can be constructed with the metal properly distributed to absorb any vibration. Instantaneous changes of feeds and speeds, together with centralized control of all levers, give the operator every opportunity for speed and finish.

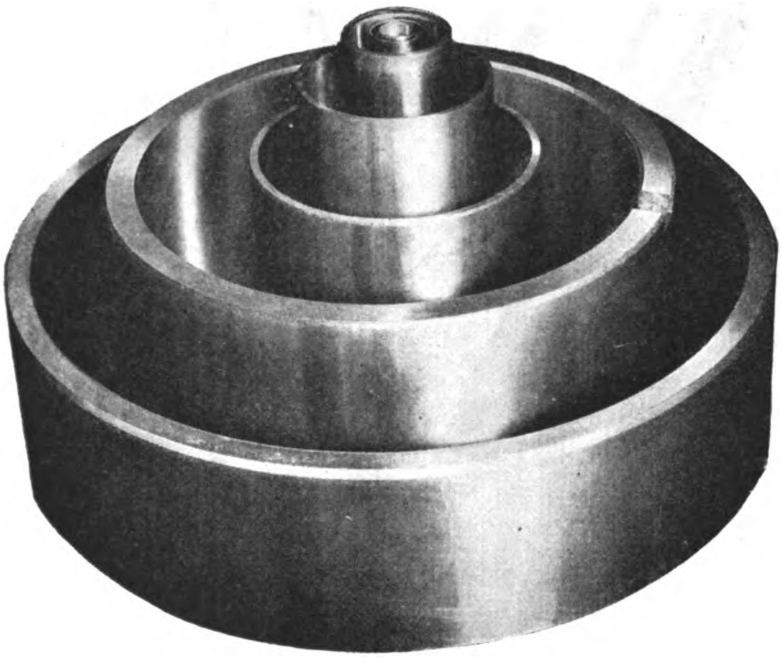
Wheel heads come in a wide range of sizes and are speedily interchangeable. By equipping with the various attachments you have practically a universal grinding unit.

The Heald is particularly desirable in tool rooms where all the work is hardened and requires extra precision.

The Heald has a place in your plant. Get in touch with our Engineering Service Department and let us give you facts and figures.

Heald No. 70 Grinder

Ball Races from ¾ in. to 21½ in. diameter



Shows Heald Range

THE HEALD MACHINE COMPANY

35 New Bond Street, Worcester, Mass.

Chicago, Ill., 26 So. Jefferson St.; **Cincinnati, Ohio,** 705 Provident Bank Bldg.; **Cleveland, Ohio,** 721 Engineers Bldg.; **Detroit, Mich.,** 400 Marquette Bldg.; **Highland, New York; Milwaukee, Wis.,** 947 41st St.; **New York, N. Y.,** 839 Singer Bldg.; **Philadelphia, Pa.,** 1302 Stephen Girard Bldg.; **Pittsburgh, Pa.,** 565 Celaron St.; **St. Louis, Mo.,** 710 Pontiac Bldg., 7th and Market Sts.; **Worcester, Mass.,** 10 New Bond St.; **Atlanta, Ga.,** The Walraven Co., 36-38 West Alabama St.; **Birmingham, Ala.;** Young & Vann Supply Co., 1725-1731 1st Ave.; **Chattanooga, Tenn.,** Hamilton Machinery Co., 204-8 Market St.; **Denver, Colorado,** Hendrie & Bolthoff Mfg. and Supply Co. 1621 17th St.; **Greensboro, N. C.,** Creensboro Supply Company; **Kansas City, Mo.,** The Faeth Co., 1117 West 8th St.; **Little Rock, Ark.,** Crow-Burlingame Co., **Los Angeles, Calif.,** Eccles & Smith Co., 241 S. Los Angeles; **McAlester, Okla.,** The Russell Hardware Company; **Minneapolis, Minn.,** The F. E. Satterlee Co., 118-120 Washington Ave. N.; **Montreal, Canada,** Geo. F. Foss Machinery Co., 305 St. James St.; **New Orleans, La.,** Oliver H. Van Horn Co., 518 Camp St.; **Omaha, Neb.,** Western Automobile Supply Co.; **Phoenix, Ariz.,** South Western Sales Co.; **Portland, Oregon,** Eccles & Smith Co., 46 Front St.; **Richmond, Virginia,** Smith Courtney Co.; **Salt Lake City, Utah.,** Salt Lake Hardware Co.; **San Antonio, Texas,** Krueger Machinery Co.; **San Francisco, Calif.,** Eccles & Smith Co., 69 First St.; **Tampa, Florida,** G. Norman Baughman Co., Florida Ave. and Jackson St.; **Toronto, Canada,** H. W. Petrie, Ltd., 131-47 Front St., W.

UNION E

for Coarse Feeds at High Speeds

"THE TOOLS Y

ND MILLS

A TYPE exactly suited to every end milling need was the plan in the minds of UNION Engineers when they developed UNION End Mills. The UNION Line embraces Straight Cut and Spiral Cut Teeth; Straight and Taper Shanks; Coarse and Fine Cutting Teeth; Right and Left Hand; Slotting End Mills; Hollow End Mills.

Thus you can see, that regardless of the nature of your product or the type of machines you operate, there is a UNION End Mill that is certain to do the work a little better and a little faster.

Metal workers need no long description of UNION Tools. They find all they need in UNION performances.

Have you tested UNION Tools on your work?

UNION TWIST DRILL CO.
DRILL AND CUTTER MAKERS
ATHOL MASS. USA

New York **Chicago**

DOMESTIC AGENTS:

Buffalo—Root, Neal & Co.
Cincinnati—V. N. Devou Supply Co.
Cleveland—White Tool & Supply Co.
Detroit—The Boyer Campbell Co.
Evansville—Evansville Supply Co.
Grand Rapids—McMullen Machinery Co.
Indianapolis—Vonnegut Machinery Co.
Milwaukee—The Phillip Gross Hardware & Supply Co.
Minneapolis—F. E. Satterlee Co.
New Haven—The Page, Steel & Flagg Co.
New Orleans—Oliver H. Van Horn, Inc., (Cutters)
Passaic—New Jersey Engineering & Supply Co.
Philadelphia—E. M. Hanson & Co.
Pittsburgh—Somers, Fitler & Todd Co.
Rochester—Homer Strong
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Syracuse—Syracuse Supply Co.
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Trenton—Warren Balderston & Co.
Worcester—Brierly-Lombard Co.

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Australia—Bevan & Edwards, Ltd., Melbourne
Belgium—Ateliers Demoor, Brussels
China—Anderson, Meyer, Shanghai
Denmark—V. Lowener, Copenhagen
England—Markt & Co., London
France—Société Aux Forges de Vulcain, Paris
Greece—A. M. Papasideris & Co.
Italy—Chas. Civita, Milano
Norway—V. Lowener, Christiania
Spain—Hijo de Miguel Mateu, Barcelona
Sweden—V. Lowener, Stockholm

OU BUY AGAIN"

COLCORD-WRIGHT
MACHINERY & SUPPLY COMPANY
METAL WORKING MACHINERY
MACHINE SHOP, FACTORY AND RAILROAD SUPPLIES
1223 TO 1229 NORTH BROADWAY
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J. W. WRIGHT, President
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J. H. BENTZEN, Secretary

August 4, 1922.

MARK REPLY FILE

S. W. Card Mfg. Co.,
Mansfield,
Mass.

Attention Mr. John Rathbun

Dear Mr. Rathbun:

It is certainly gratifying to note from your letter that our business on taps and dies compares favorably with that of your jobbers in other sections. It is a pleasure to sell tools that give the satisfaction that "Card" products do. Considering the number of tools that we have sold in the past years, the complaints have been practically nil, and furthermore, our connection with the S. W. Card Company has been everything that could be desired.

We wish to take this opportunity to thank yourself and Mr. Strople for the co-operation which you have given us and we believe that the future will bring still better results.

With kindest regards from all the boys and myself,

I am

Yours truly,
V. H. Carter.

VHC/G

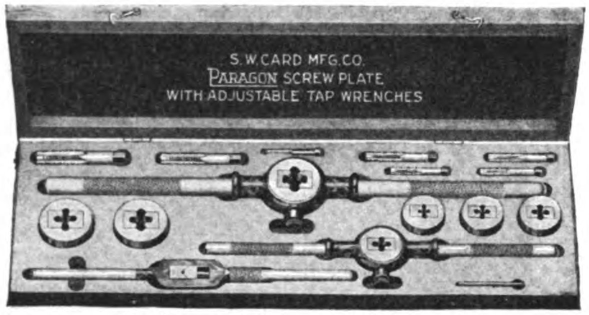
It is a make

Throughout these years CARD SERVICE has made a host of such friends who appreciate its genuineness.

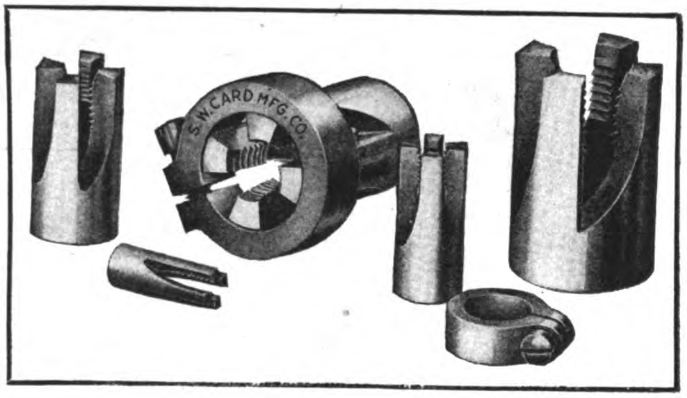
FOREIGN AGENCIES: CHARLES CHURCHILL & CO., London, Birmingham, Manchester, Glasgow, and Newcastle-on-Tyne. V. LOWENER, Verterbrogade 9 B, Copenhagen, Denmark. AUX FORGES DE VULCAIN, General Office and Salesroom, 3 Rue St. Denis, Paris; Important Branches and Showrooms, Lyons, Bordeaux, Lille. V. LOWENER'S MASKINFORRETNING, Sverre Mohn, Christiania, Norway. C. CIVITA, Milano, Italy. R. S. STOKVIS & ZONEN, LTD., Rotterdam. V. LOWENER, Drotting-

great pleasure, Mr. Carter, to tools that give the satisfaction that "CARD" products do.

We've been making them that way for over 48 years



List No. 500 Paragon With Guides



List No. 301 Diamond Without Guides

These are just a few examples of our complete line of Threading Tools. Catalog No. 30 gives them all. Write for a copy today. Let us show you what real Service is like.

The CARD Quality

S.W.CARD MFG.CO.

DIVISION OF UNION TWIST DRILL CO.

MANSFIELD, MASSACHUSETTS, U.S.A.

gatten, 90, Stockholm, Sweden. HIJO DE MIGUEL MATEU of Barcelona and Bilbao, Spain. R. D'AULIGNAC, Barcelona, Spain. ATELIERS DEMOOR, Brussels, Belgium. A. M. PAPASIDERIS & CO., Athens, Greece. ANDERSON, MEYER & CO., LTD., Shanghai, Changsha, Hankow, Harbin, Hongkong, Kalgan, Pekin, Tientsin Vladivostok, China. M'ESTRE & BLATGE, Rio de Janeiro, Brazil, Buenos Aires, Argentine Republic.

Motors & Control

The Westinghouse S K type direct current Motor and a battery of Lathes equipped with this motor.

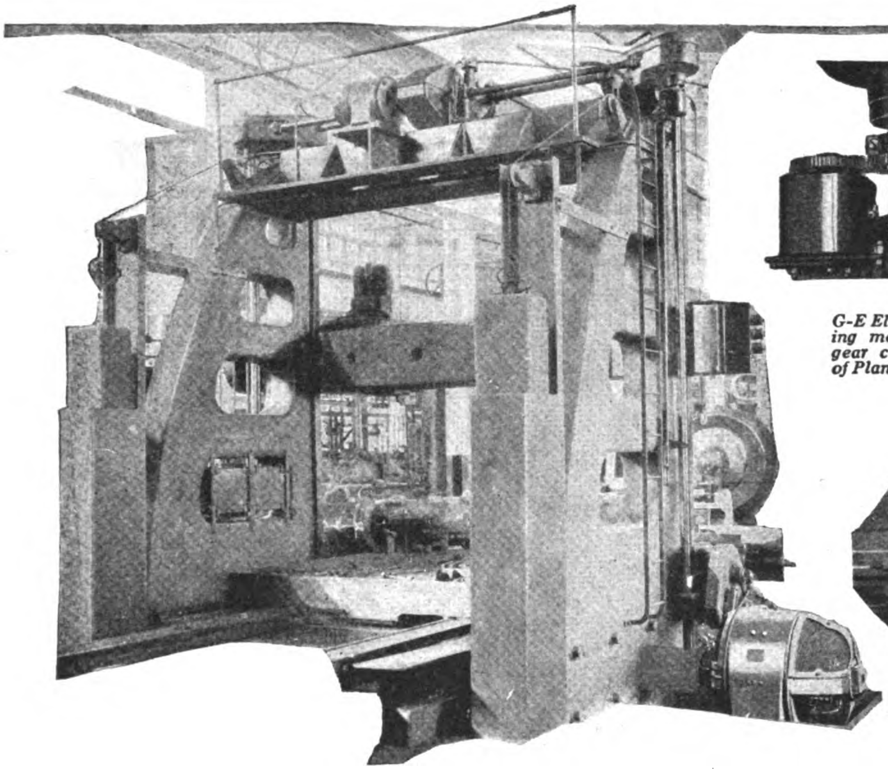
Realizing this condition Westinghouse renews its proffer of earnest cooperation with machine tool designers, builders and users.

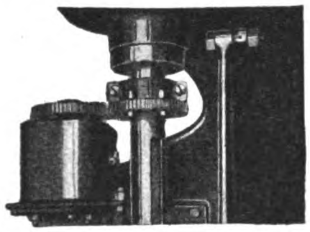
The development of new tools will continue and with this development the need for electric motors to successfully operate these tools will also continue.

Westinghouse experience in such work is at the service of the machine tool industry. A card to our nearest district office will bring it to you.

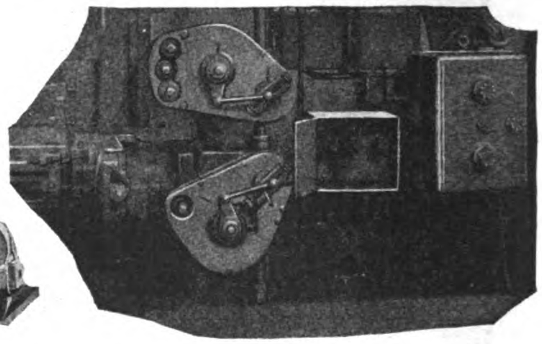
Westinghouse Electric & Manufacturing Co.
East Pittsburgh, Pa.
Offices in all principal American Cities

Reversing Planers give most satisfactory service when operated completely by electrical equipment





G-E Electric Feed Limit Switch, showing method of mounting—and split gear clamped to Feed Drive Shaft of Planer.



G-E Type RF Direct-Current Reversing Motor Drive, with Electric Feed—the most highly developed electrical equipment for large planers.

G-E Control Panel for Planer Electric Feed—type in which Cross Rail motor is used for Feed.

Electric Feed Increases Efficiency

The direct-current reversing planer equipment manufactured by the General Electric Company now includes electric feed. For large reversing planers this is the ideal equipment.

The usual feed devices on planers do not begin to feed until the motor has actually started in the reverse direction. The electric feed operates the instant the tool clears the work instead of at the point of reversal as with the mechanical feed—which increases the time efficiency of the planer since the usual drift or over-travel can be decreased. A single motor can be used for combined feed and cross rail drive.

Requirements for reversing planer service demand a motor which accelerates and brakes in the shortest practicable time, and commutates through a continuously reversing cycle. The G-E Type RF direct-current adjustable speed motor admirably meets all these requirements—over 1200 are in this service.

Specialists of the General Electric Company co-operate with manufacturers of machine tools in advancing the efficiency of machine shop equipment. By this means or direct, they are at your service.

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

43B-648

What do you think about the idea of standardizing on one make for all your threading tools?

Certainly the convenience, the time and cost saving, the simplification of your problems of design and other advantages resulting from the use of one make of threading tools must appeal to you.

The 101 varieties in which **Murchey Collapsible Taps and Self-Opening Dies** are built, make it possible for you to standardize on **MURCHEY.** But aside from the "variety" feature Murchey Tools and Murchey Service will give you better threading because:

1. The high-speed chasers will cut five times the number of threads a solid carbon tool will cut. And the chasers sell for about the same price as a solid tool. Here's economy.
2. Machines can be operated at twice the speed of machines with carbon tool set-up. Here's production doubled.
3. No backing out. Chasers recede at end of thread and tool is withdrawn without reversing machine. Here's production doubled again. Moreover, cleaner-cut threads at less attention on the operator's part.
4. Cost less to operate, maintain and keep in stock, adjustable features making it possible for one Murchey Tool to take the place of several solid tools of close sizes. Here's less running to the tool crib and a tidier, less conjested tool crib.
5. Simple design and few parts. Only eleven parts to a Murchey Collapsible Tap and fifteen parts to a Murchey Self-Opening Die. Here's safety and less cussing.
6. One hundred and one standard sizes to fit any job or machine where a solid tool can be used—drill press, tapping machine, automatic boring mill, turret lathe, etc. Here's an opportunity to pass the buck to us on any threading job that otherwise would be a sticker.
7. Prompt shipments. Here's what you want when you need it.

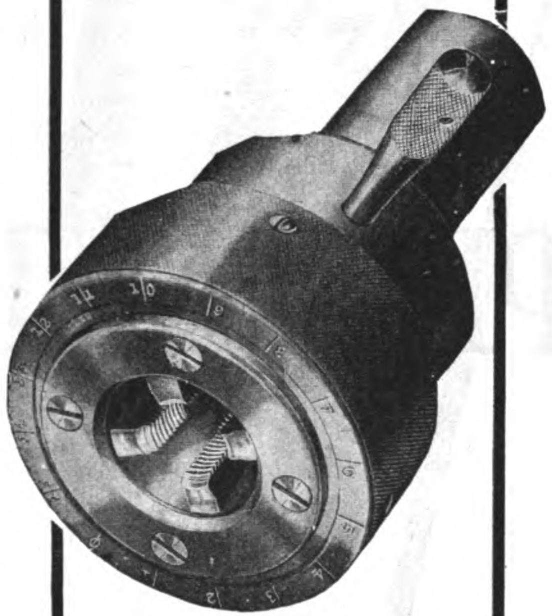
Try a Murchey at our expense. Write today for the size you want. Our Catalog you will find very convenient if you do any threading. We'll send it too.

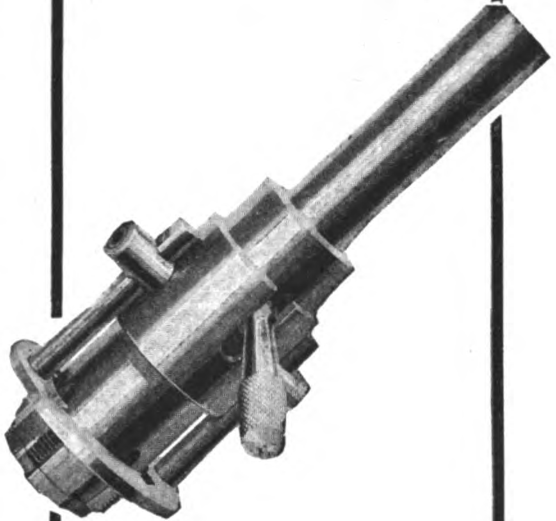
Murchey Machine and Tool Co.

953 Porter Street, Detroit, Mich., U. S. A.

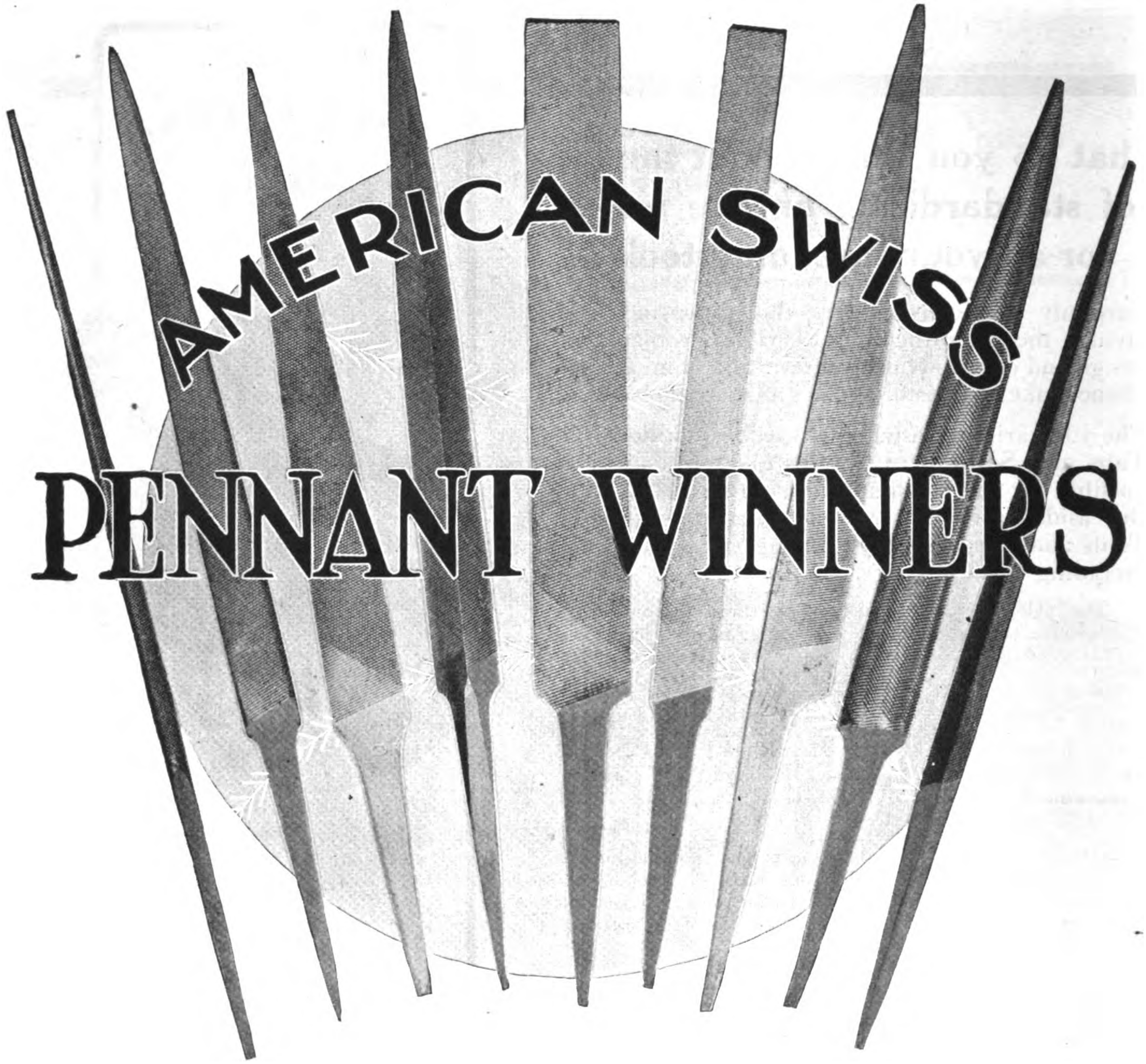
New York Office, 99 Warren Street; Cleveland Office, 6523 Euclid Avenue; Pittsburgh Representatives, Laughlin & Barney, Union Arcade Bldg.; Chicago Representatives, R. E. Ellis Engineering Co., 621 Washington Blvd.; Los Angeles Representative, Smith, Booth & Usher, 228 Central Ave.; San Francisco Representative, Smith, Booth & Usher Co., 50-60 Fremont St.; Coats Machine Tool Company, 14 Palmer Street, Westminster, London, S. W., England; Fenwick, Freres & Company, 8 Rue de Rocroy, Paris.

MURCHEY DIES





TAPS MURCHEY



A single player, a single game, nor an extra spurt in an emergency—these alone cannot win the championship pennant. That truth holds good in both the shop and the great national game.

The realization of that fact has been behind the unquestioned championship of AMERICAN SWISS FILES, whose real supremacy among files of precision has been proved time after time.

This leadership is based not merely on an occasional "freak" file, or a few out of each dozen, but on the efficiency quality of every AMERICAN SWISS FILE.

Distinctive American methods have achieved a *uniformity* of temper and spacing not heretofore possible. The result is a championship team of 2400 "stars" representing our product.

America's leading supply houses are listed below. Call on the nearest house to select for you the right pennant-winning "Star and Cross" file.

AMERICAN SWISS FILE & TOOL CO., ELIZABETH, NEW JERSEY

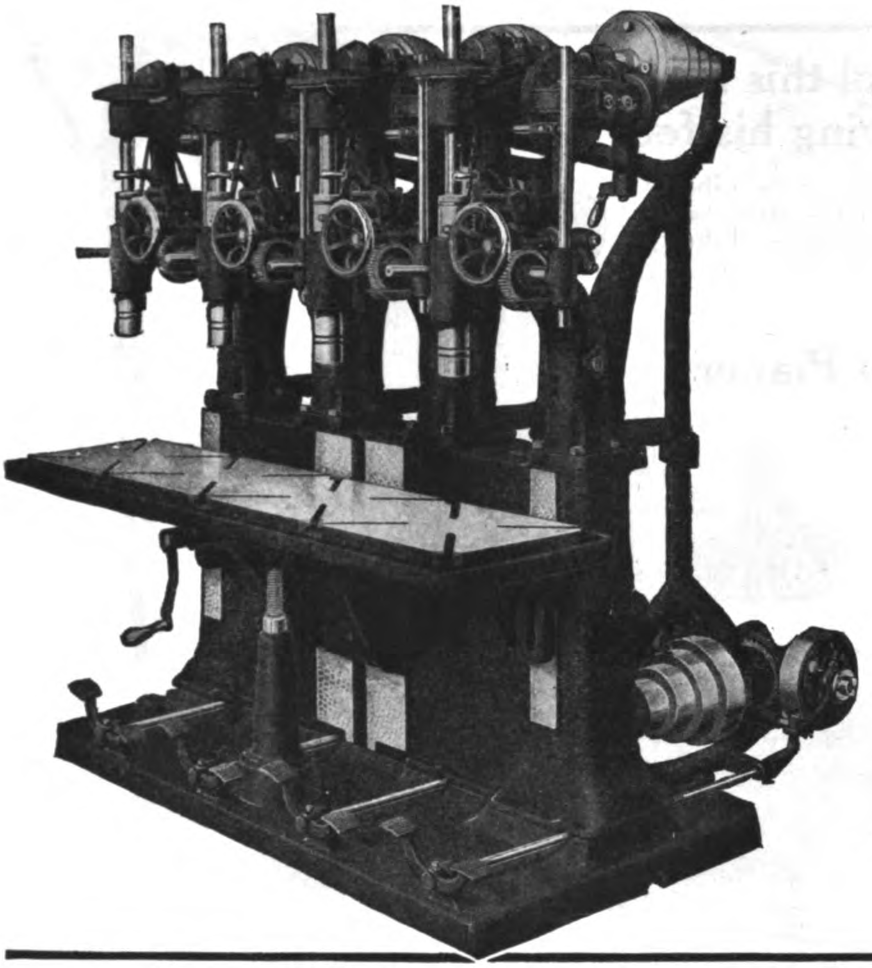
New York Office: **E. P. Reichhelm & Co., Inc., 26 John St.**

Address all Communication to 26 John St., New York.

Anchor Tool & Supply Co., New York City; Aetna Machinery Co., Philadelphia, Pa.; Boyer-Campbell Co., Detroit, Mich.; Chandler & Farquhar Co., Boston, Mass.; Coghlin-Kirby Machinery & Supply Co., Toledo, Ohio; Ducommun Hardware Co., Los Angeles, Cal.; Peter A. Frasse & Co., Inc., New York City; Hamilton Hardware Corp., Waterbury, Conn.; M. D. Larkin Supply Co., Dayton, Ohio; Ludlow & Squier, Newark, N. J.; C. S. Mersick & Co., New Haven, Conn.; Machinists Supply Co., Chicago, Ill.; Machinists Supply

FILES ONLY THE BEST ARE GOOD ENOUGH TOOLS
TRADE MARK

Co., Pittsburgh, Pa.; C. W. Marwedel & Co., San Francisco, Cal.; Sidney B. Roby Co., Rochester, N. Y.; Chas. A. Strelinger Co., Detroit, Mich.; Louis F. Seitenreich, Buffalo, N. Y.; Syracuse Supply Co., Syracuse, N. Y.; Tracy, Robinson & Williams, Hartford, Conn.; White Tool & Supply Co., Cleveland, Ohio; Clark Hardware Co., Elizabethport, N. J.; E. K. Morris & Co., Cincinnati, Ohio; St. Louis Machinist Supply Co., St. Louis, Mo.; Vonnegut Hardware Corp., Indianapolis, Ind.



BARNES DRILLS

Upright
Horizontal
Gang

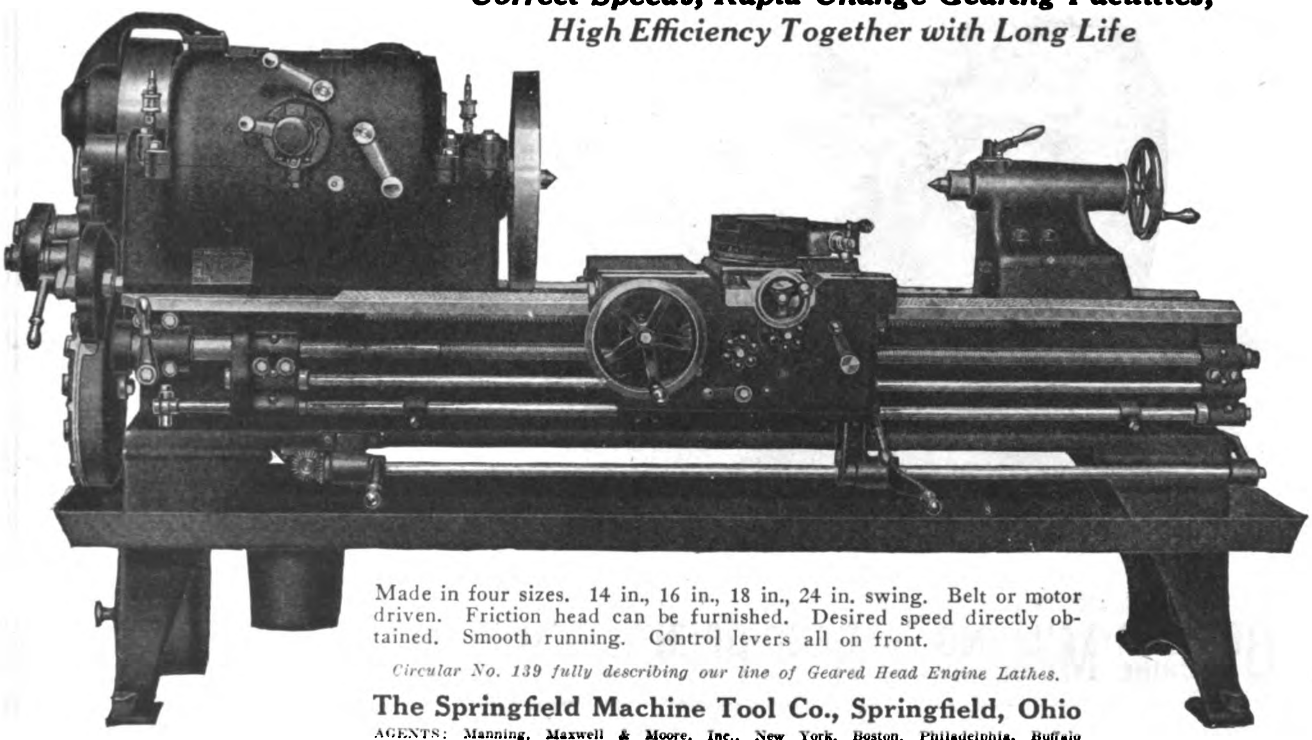
Convenience of Operation
Accuracy—Strength

8 to 50 inch Swing, with or without Tapping Attachment

W. F. & John Barnes Co.
1995 Ruby St., Rockford, Ill., U. S. A.

SPRINGFIELD—IDEAL

A Geared Head Engine Lathe of High Power, Correct Speeds, Rapid Change Gearing Facilities,
High Efficiency Together with Long Life



Made in four sizes. 14 in., 16 in., 18 in., 24 in. swing. Belt or motor driven. Friction head can be furnished. Desired speed directly obtained. Smooth running. Control levers all on front.

Circular No. 139 fully describing our line of Geared Head Engine Lathes.

The Springfield Machine Tool Co., Springfield, Ohio

AGENTS: Manning, Maxwell & Moore, Inc., New York, Boston, Philadelphia, Buffalo Syracuse, New Haven, Pittsburgh, St. Louis, San Francisco, Seattle, Cincinnati; The E. L. Essley Machinery Co., Chicago, Ill.; The Riverside Machinery Depot, Detroit, Mich.; The Cleveland Duplex Machinery Co., Cleveland, Ohio.

Versatility and Precision are Balanced

The Mehl Machine Tool & Die Co., Roselle, N. J., give *"machine tools"* as a reason for their unexcelled service.

They do not buy a lathe just because it has swing and distance between centers—they insist on one that will do more than a lathe is ordinarily supposed to do.

Any lathe that operates in the Mehl plant must possess unquestioned precision qualities. Further than this, it must have a broad and varied machining range.

For the past five years, Sixteen Ames Bench Lathes have been producing Mehl-made tools, dies, jigs, fixtures, etc.

With these Sixteen Ames Bench Lathes they do grinding of drill jig bushings (both internal and external), arbor turning and grinding, grinding locating blocks and parts in general for jig, fixture, die and tool work. Straight and taper turning and grinding. Milling, boring and turning small cutters, tools and gauges. A pretty good range of work for a Bench Lathe, but nothing out of the ordinary for an *Ames*.

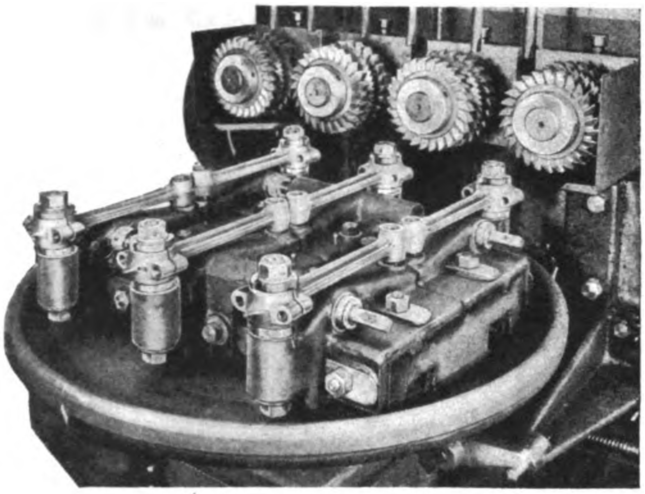
One machine tool in the Mehl plant is worth talking about, but when the number nears a score, we allow you to judge. Further facts and figures for the asking.

This Ames Bench Lathe is doing an internal grinding job on a machine steel Drill Jig Bushing. The limits required on this part are 0.00025 in. Such tolerances are readily held on

AMES
Bench Lathes

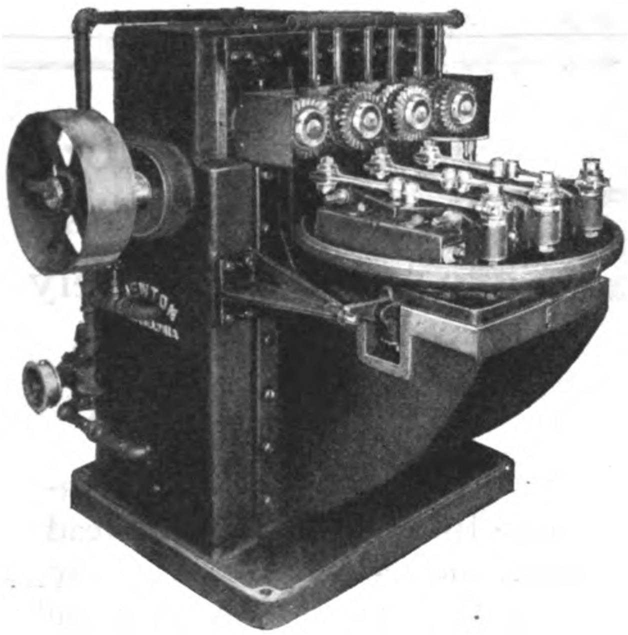
B.C. AMES CO.
WALTHAM MASS. U.S.A.

For facing and slotting in one operation and at high speed



One set of fixtures is loaded while cut is being taken on work in other set

NEWTON
Model C-76
Four-Spindle, Knee-Type Milling Machine



A new machine for facing and slotting connecting rods in one operation at high speed.

Production is increased by loading one set of fixtures while the cut is being taken on work in the other set. No time is lost between cuts other than to index the table which is done easily and rapidly.

Allowing two seconds for this operation the production is 225 rods per hour or 1,620 rods in an 8-hr. day. An accurately finished job is done on every piece produced. (See description on page 505 of Sept. 28th issue of *American Machinist.*)

Let us tell you all the many fine details of this easy operating, accurate and productive milling machine. Write today for complete information.

NEWTON MACHINE TOOL PLANT
of

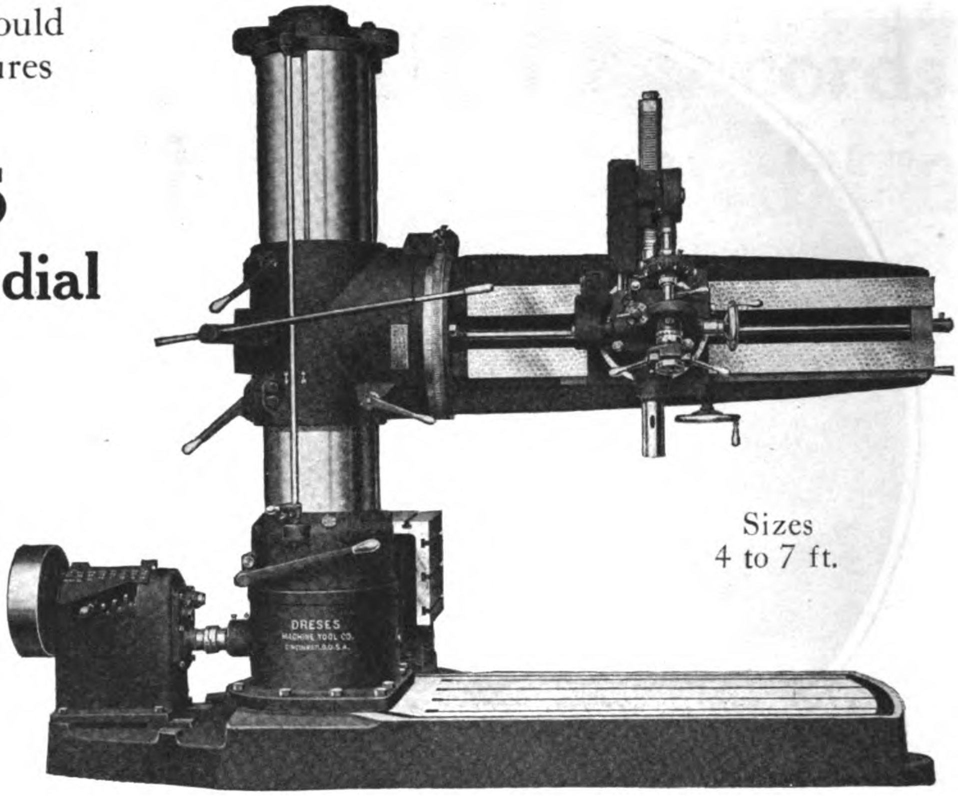
TOOL CORPORATION

America

Del. **NEWTON MACHINE TOOL PLANT, Philadelphia** **COLBURN MACHINE TOOL PLANT, Cleveland, Ohio**
17 East 42nd St., New York
Philadelphia, Pittsburgh, Chicago, St. Louis

Your next Radial should
Embody these Features
found on the

DRESES
Universal Radial
(Half and Full)



To overcome defects common to universals we have staggered the arm socket, bringing the spindle more central and also allowing a long bearing for the shaft in the saddle.

The head swivels in a reinforcement on the saddle which greatly increases the rigidity of both parts.

To overcome the usual complications of intricate gearing in the head, the back gears are placed on the girdle.

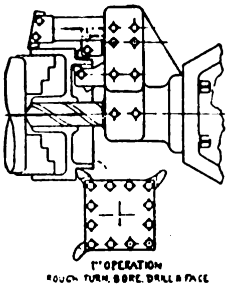
A large number of other distinctive features deserve your close attention.

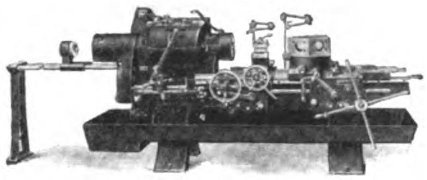
Write for printed matter telling the whole story.

Dreses Machine Tool Company, Cincinnati, Ohio

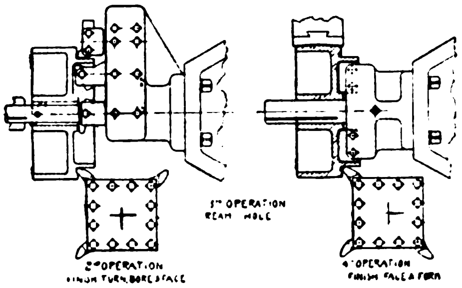
REPRESENTATIVES: Manning, Maxwell & Moore, New York, Boston, Philadelphia, Chicago, and St. Louis; Carey Machinery & Supply Co., Baltimore; William K. Stamets, Pittsburgh; Wolverine Machinery & Supply Co., Detroit; Berger & Carter Co., San Francisco and Los Angeles; Alfred Herbert, Ltd., Coventry; R. S. Stokvis & Zonen, Rotterdam; R. S. Stokvis & Fils, Paris and Brussels; Schuchardt & Schutte, Stockholm and Copenhagen.

Multiple Turning Tools on the I-B FOSTER Sets the Pace





Universal Turret Lathes—3 Sizes



The W. A. Barker Wrenchless Chuck

W. A. Barker Wrenchless Chucks quickly pay their cost by increased production. They reduce the chucking time.

The power rigidity and adaptability of every Foster makes the use of multiple tooling possible and the complete finishing of parts in the time required for the longest cut.

Note in the 1-B operation diagram for clutch pulleys—five cutters working simultaneously in the first and second operation, four in the fourth. The pulley is entirely finished in the time required to turn the outside diameter, except reaming the hole.

Send us your blue prints, let our engineers show you what multiple tooling will do for you.

THE FOSTER MACHINE CO. **Elkhart, Ind.**

Carolina, Clinchfield and Ohio Railway

N.C.&St.L.

ERIE RAILROAD COMPANY

GRAND TRUNK SYSTEM

SOO LINE

CANADIAN NORTHERN

MAINE CENTRAL RAILROAD

The Trunk Roads of the World make daily use of

FOOTBURT

equipment

Over 70 railroad systems in America alone are using **FOOTBURT** drilling, boring, tapping and special machines, of practically any number of spindles from one up.

FOOTBURT performance and the **FOOTBURT** engineering service have been so outstanding that in many instances competitive bids are not called for—for we have proved time after time that the **FOOTBURT** way is the economical way.

The judgment of the 50 roads pictured here is echoed by the leaders in the automotive, farm machinery, and scores of other fields.

May we discuss with you how FOOTBURT, pioneers for 30 years in this field, can save money in YOUR Shop? Write today.

Foote-Burt Company
Cleveland, Ohio

Detroit Office: 5928 2nd Boulevard
Milwaukee Office: 1143 Wells Building

Pioneers in Better Drilling Methods

C&O LINES

FRISCO LINES

Chemins de Fer de Paris à Lyon & à la Méditerranée

CHICAGO NORTH WESTERN LINE

CANADIAN PACIFIC RAILWAY

CENTRAL OF GEORGIA RAILWAY CO.

NORTHERN PACIFIC

THE ALTON ROAD

CENTRAL R.R. of N.J.

BALTIMORE & OHIO R.R.

PHILA. & READING R.R.

UNION PACIFIC SYSTEM OVERLAND

THE MKT

MISSOURI PACIFIC IRON MOUNTAIN

MICHIGAN CENTRAL R. R.

Santa Fe

DENVER & RIO GRANDE R.R. SCENIC LINE OF THE WORLD

NASHVILLE CHATTANOOGA AND ST. LOUIS RY. LOOKOUT MOUNTAIN ROUTE

THE TRANS-CONTINENTAL LINE

The Reading

L&N

Big Four Route

MISSOURI PACIFIC

CH&D

Chicago Great Western

Chicago & Western Indiana Railroad

PITTSBURGH & LAKE ERIE R. R.

Rock Island

"Follow the Flag" WABASH

Norfolk & Western

THE SOUTHERN SERVES THE SOUTH SR

MOBILE & OHIO RAILROAD COMPANY

PENNSYLVANIA LINES

Burlington Route

GREAT NORTHERN RAILWAY GLACIER NATIONAL PARK

NEW YORK CENTRAL LINES

SOUTHERN PACIFIC LINES

NICKEL PLATE ROAD THE NEW YORK, CHICAGO & ST. LOUIS R.R.

PERE MARQUETTE RAILROAD

CHICAGO, MILWAUKEE & ST. PAUL RAILWAY

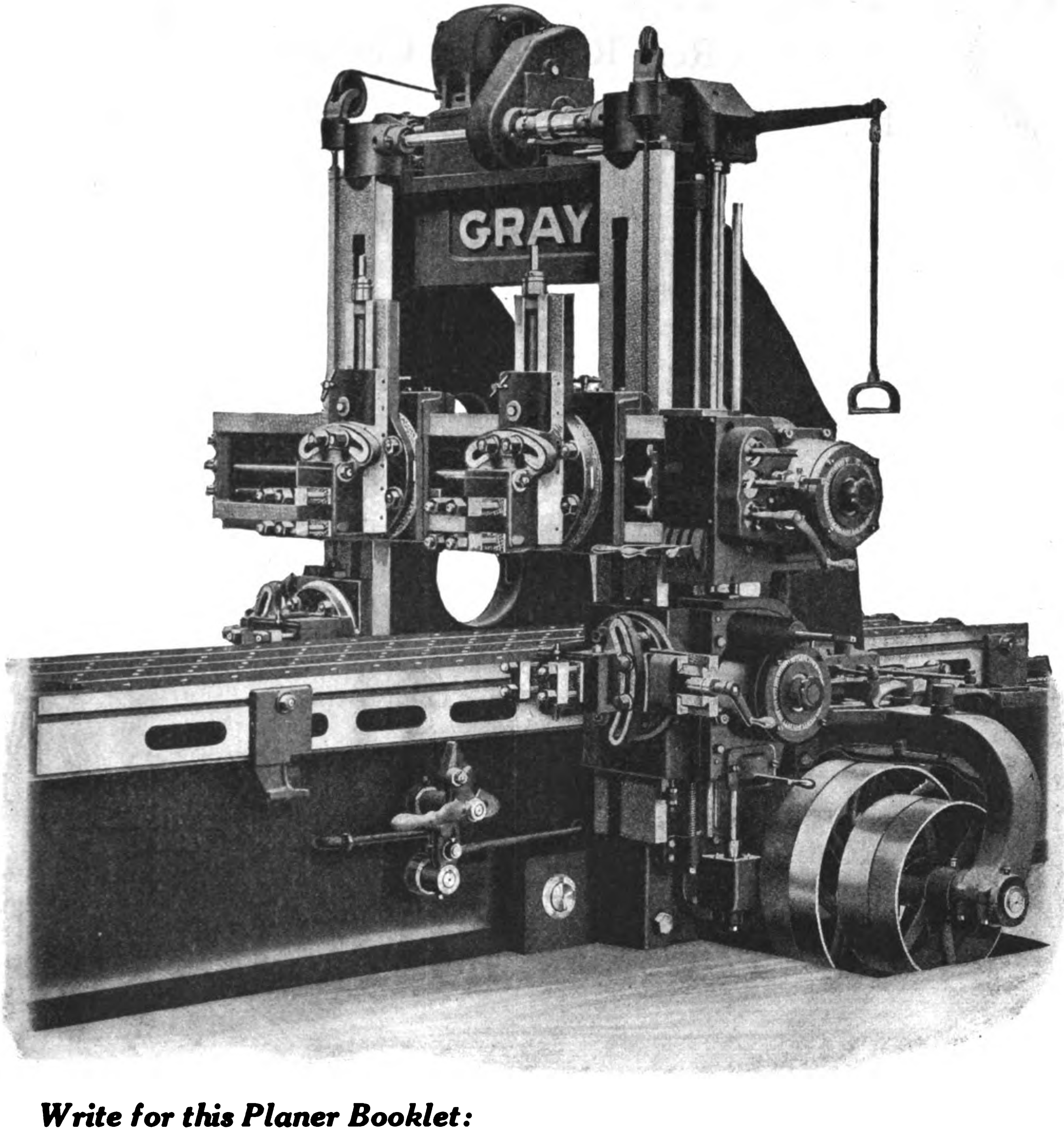
Lackawanna Railroad

CENTRAL VERMONT RAILWAY

VICTORIAN RAILWAYS CO. OF AUSTRALIA

BOSTON AND MAINE RAILROAD

Gray Planers



Write for this Planer Booklet:

It describes a remarkable development in machine tool design.

You will find it intensely interesting as it illustrates a new type of helical gearing, running in oil, a "can't-slip" feed that is set as simply as turning a door knob, a rapid traverse actuated by shifting a single lever, a rail setter and rail lock that can be operated without taking a single step, and a forced lubricating system that supplies all driving shafts as well as the V's with filtered oil.

If you're interested in machinery you'll be interested in this booklet. Write for a copy today.

THE G. A. GRAY CO.
Cincinnati, Ohio

FIREFRAX

At Last a Real Refractory Cement—

FOR YEARS you have been using a fireclay mortar or a low temperature fluxing cement for laying-up and repairing fire-brick linings.

Such cements have never proved entirely satisfactory.

But here is a new cement—a super-refractory cement—made in accordance with a new principle—a real refractory cement that has high bonding power.

Tests have proved that—

- Firefrax Cement will bond at room temperature—
- It will not lose its strength at any commercial temperature—
- It does not boil or blister but forms a dense refractory body—
- It bonds but does not soften the fire-brick—
- It is plastic—easily and quickly applied—
- It is more economical to use.
- Yet it is sold at the price of ordinary cements—

Use Firefrax in laying-up and patching brick work. Use it as a bonding cement with Carborundum firesand or crushed fire-brick in making rammed linings and you are assured of longer-lived linings at lower costs.

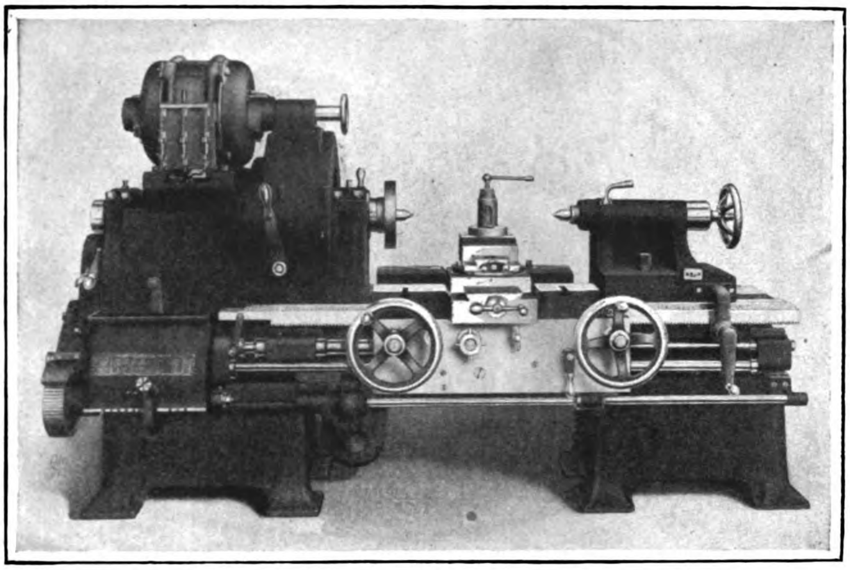
Incidentally, if your furnace conditions are so severe that fireclay brick will not stand up, you should be using Carbofrax Brick.

Ask our Sales Engineering Department about any problem that has to do with refractories

The Carborundum Company, Perth Amboy, N. J., U. S. A.

New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Grand Rapids, Milwaukee. Williams & Wilson, Ltd., Montreal

FIREFRAX



Flather 24-inch Motor Driven Lathe

FLATHER

Can Your Lathe Beat Your Watch?

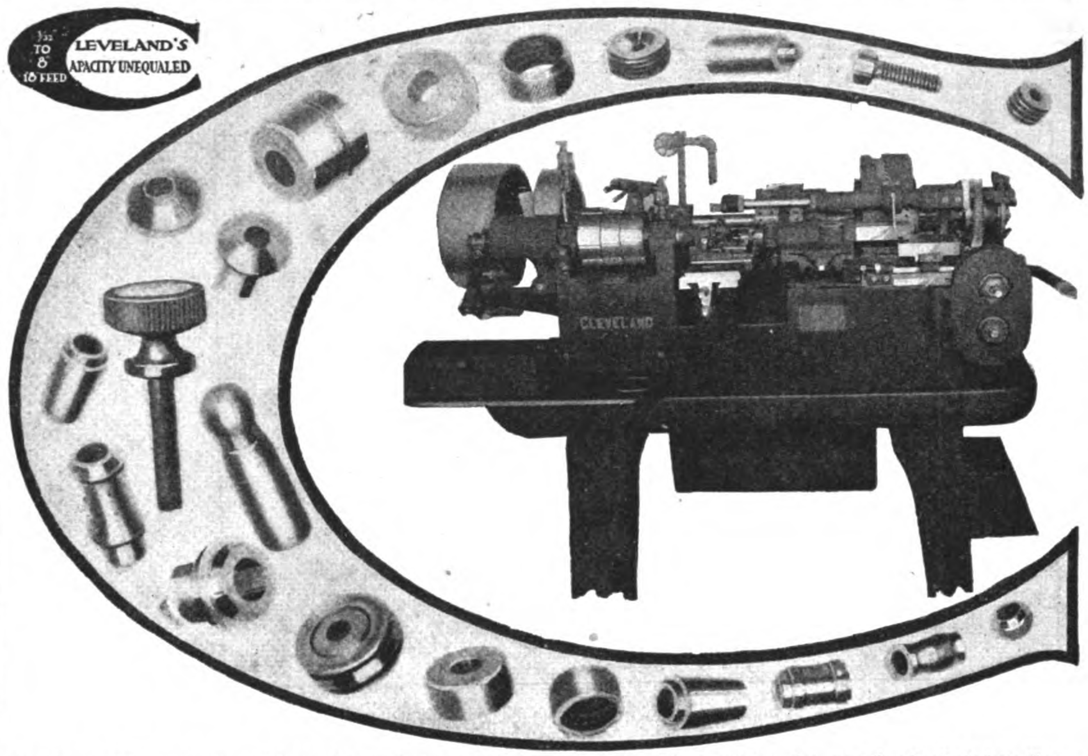
The hands of your watch may seem to move slowly, but they're a mighty hard opponent to beat in a race with time. That is the race your machines run every day, with your profits as the stake.

How do your lathes stand in the lists? Do they show 100% wins? If they don't, then you are losing money.

The remedy is to install Flather Motor Driven Lathes and be sure of beating your watch every time, regardless of handicaps in the way of heavy work.

Write for our Catalog; it contains news of real importance

Flather & Co., Inc.
Nashua, N. H.



Selecting the Right Machine for the Work is the Practice of Today

Tieing up big machines with small products cannot be tolerated in today's production scheme.

The plant manager looks for a machine that permits of quick tooling, continuous cutting and one that requires little supervision.

He naturally chooses Cleveland Automatics. **All the nuts, screws and like parts shown in the big "C" were fashioned on the Cleveland High-Speed**, Double-Tool Spindle Machine.

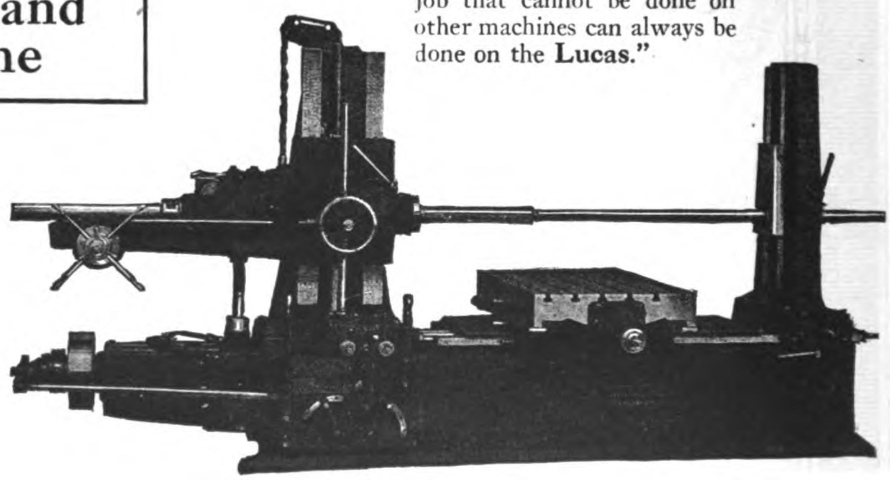
The "Cleveland" is sure to fit nicely in some of your operations. Let us show you.

The Cleveland Automatic Machine Company, Cleveland, Ohio

When no other machine will do it—put it on the Lucas

"PRECISION"
Boring, Drilling and Milling Machine

Lucas latitude is well known in the majority of shops. It is designed to perform a variety of machining operations with a single set-up of the work. Some users have said "any job that cannot be done on other machines can always be done on the **Lucas**."

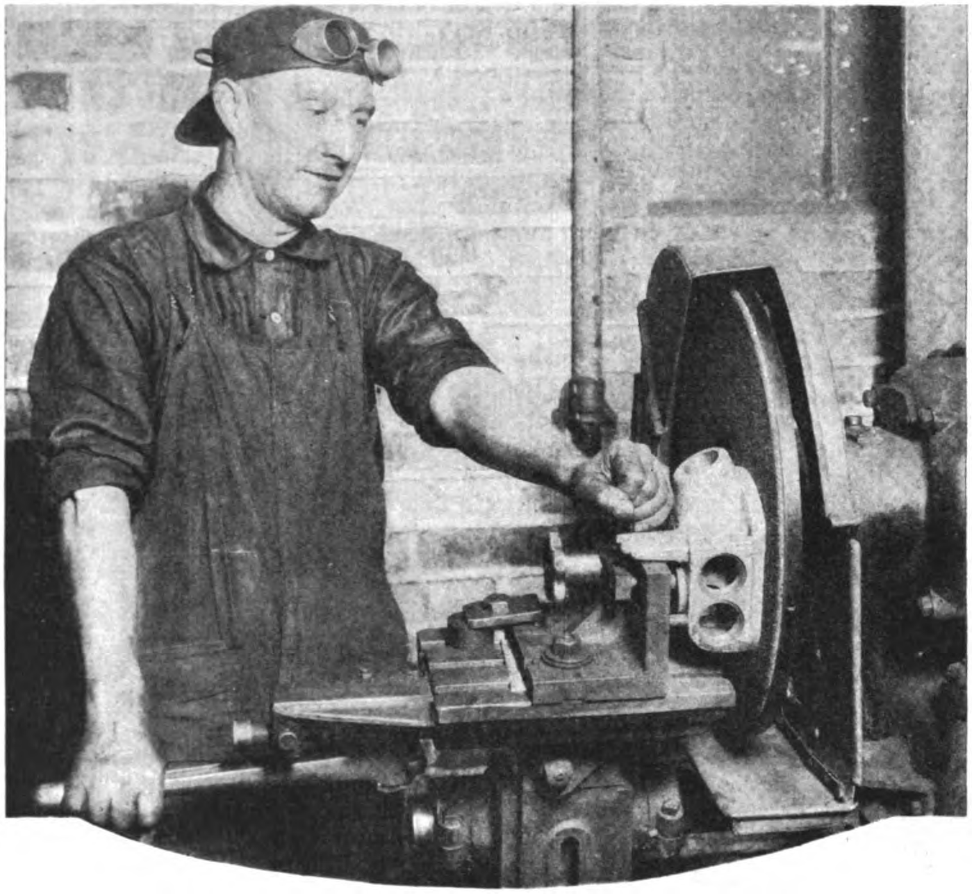


The **Lucas** is rigid, sturdy and precise. It is a real three-shift tool that never lays down—no matter what you set up to it. The **Lucas** and the operator work in harmony — manufacturers know the value of team work.

Lucas Machine Tool Co. NOW AND ALWAYS OF **Cleveland, Ohio, U. S. A.**

AGENTS:
Alfred Herbert, Ltd., Coventry; Societe Anonyme Belge, Alfred Herbert, Brussels; Aux Forges de Vulcain, Paris; Allied Machinery Co., Turin, Barcelona, Zurich; Benson Bros., Sydney, Melbourne; V. Lowener, Copenhagen, Christiania, Stockholm; R. S. Stokvis & Zonen, Rotterdam; Andrews & George Co., Tokyo.

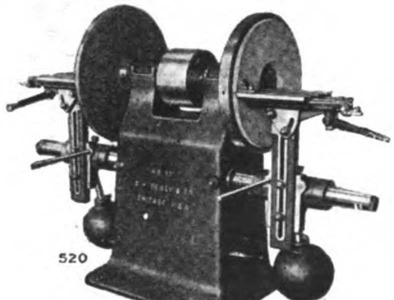
BESLY GRINDERS



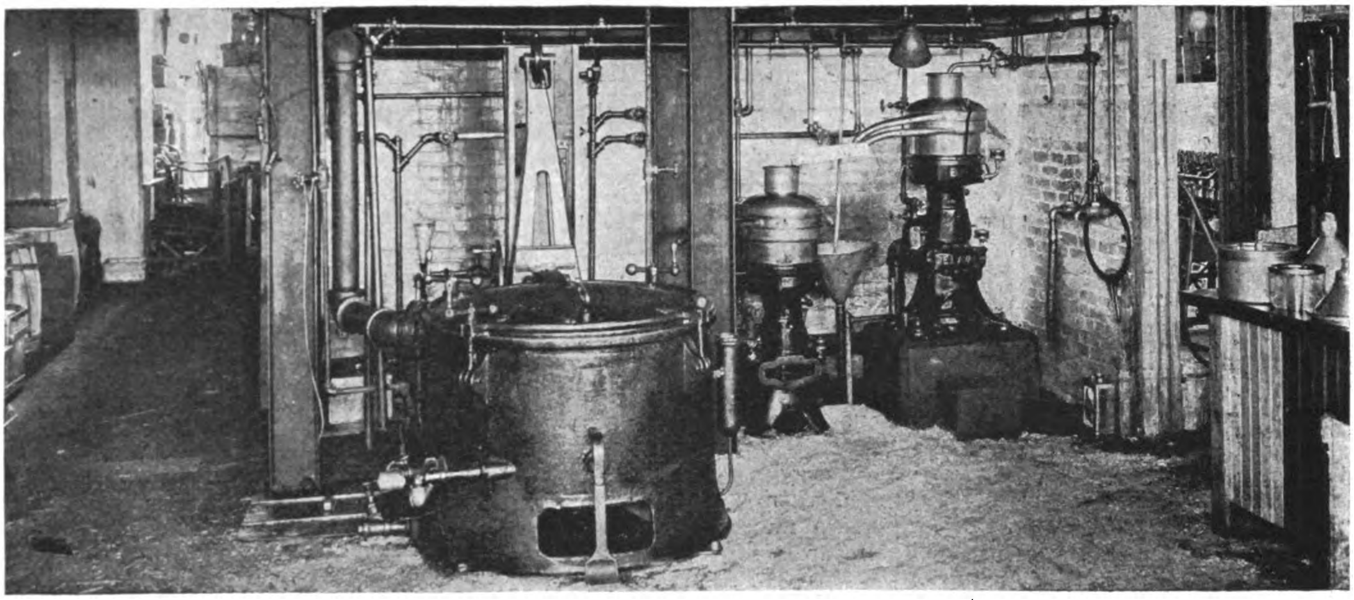
THE Wayne Tank and Pump Co., Fort Wayne, Ind., consider their Besly Grinder a valuable production asset—Mr. W. F. Brandt, General Factory Superintendent, says—"In April 1918 we equipped our plant with a Besly Grinder and it has done very satisfactory work. This machine is used to finish the facing of cast-iron valve bodies used in the construction of our supervisible pumps. The parts illustrated are about 8 in. long and 10 in. in diameter. This essential work is handled with ease and economy—"

Besly Grinders make an important place for themselves wherever they are installed. Initial cost is low, they require no skill to operate and maintenance is negligible.

Send us samples or drawings of your flat surfacing work and let us tell you how to cut the cost of that expensive job.



Charles H. Besly & Company
125 North Clinton Street, Chicago, U. S. A.
Originators of Disc Grinders



De Laval Oil Purifier and De Laval Multiple Clarifier as installed to purify used cutting oil in a large automobile factory

De Laval Oil Purifiers save the cutting oil that is now wasted in chip piles

Every large machine shop or manufacturing plant has its chip pile. And nearly every chip pile represents a waste of cutting oil as great as that which was taking place in the plant of this well-known automobile manufacturer, whose oil reclaiming equipment is shown above.

With the method of reclaiming previously used, 3½ gallons of cutting oil were consumed for each car manufactured. The installation of De Laval Centrifugals and a steam-driven extractor, together with an improved handling method, has lowered this consumption to less than 2 gallons per car, a saving of about 40%.

De Laval Centrifugals make it possible to apply steam to your chips and so recover the oil which adheres to them when other methods of cleaning are employed. And when this oil has been passed through the De Laval it is clean. Consequently cutting edges last longer; there is less smoking of the work; production is increased, and the cases of septic poisoning which frequently follow the use of dirty cutting oil are practically eliminated.

You'll be interested in knowing more about the De Laval Method of Reclaiming Cutting Oil. Write for Bulletin No. 101.

The De Laval Separator Company

165 Broadway, New York **29 East Madison Street, Chicago**

DE LAVAL PACIFIC COMPANY

San Francisco

Gentlemen: Please forward a copy of the new De Laval Bulletin No. 101, which tells how we can save cutting oil and increase production by installing De Laval Centrifugals.

Name ....

Company ....

Address ....

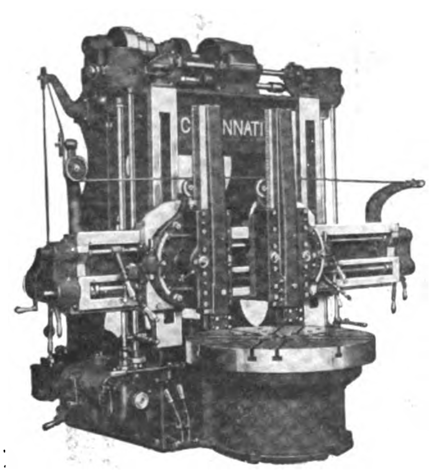
....

A.M.

CINCINNATI
PLANERS *Original Thru out* BORING MILLS

Carrying Water in a Sieve

is rather an unsatisfactory procedure, but it is no more hopeless than trying to get big production and high-quality work from old-type planers and boring mills.



Sizes 42 in. to 12 ft.

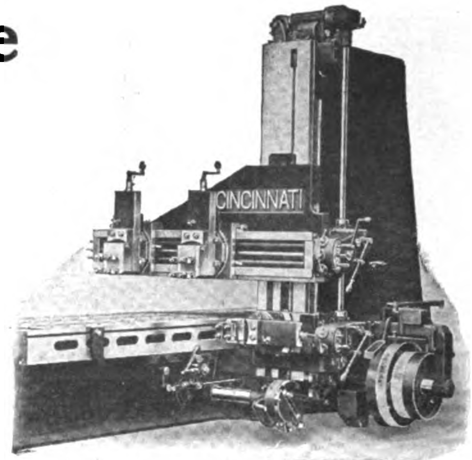
Cincinnati Planers are several steps ahead of the Production Precision parade. They possess absolutely *new* features that make them necessary to the modern manufacturer.

Here are a few:

RAPID POWER TRAVERSE, the Patented Tu-speed, Box Arch. Bed and Table, Herringbone Gears and Forced Lubrication.

The new Boring Mill features are equally important. We suggest your immediate investigation.

Get a Cincinnati Catalogue



Standard Sizes 22 in. to 120 in.
Open Side Planers 30 in. to 72 in.

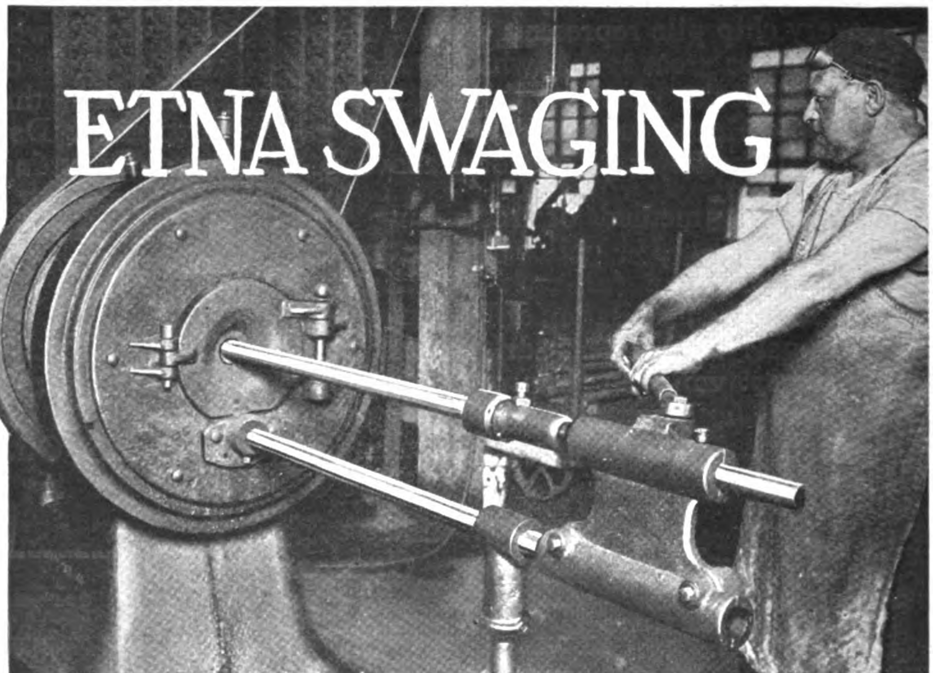
The Cincinnati Planer Co.
Cincinnati, Ohio, U. S. A.

800 Operations Every 9 Hours

Two Etna Swaging Machines reduce these propeller shaft ends from 1$\frac{3}{4}$ in. to 1$\frac{1}{4}$ in. diameter—both operation and its result are here shown.

The shafts are made of number 10 gage tubing. Swaging thickens the wall of the tubing, facilitating an unusually strong welded joint. A splined shaft is welded to one end and a universal ball yoke to the other.

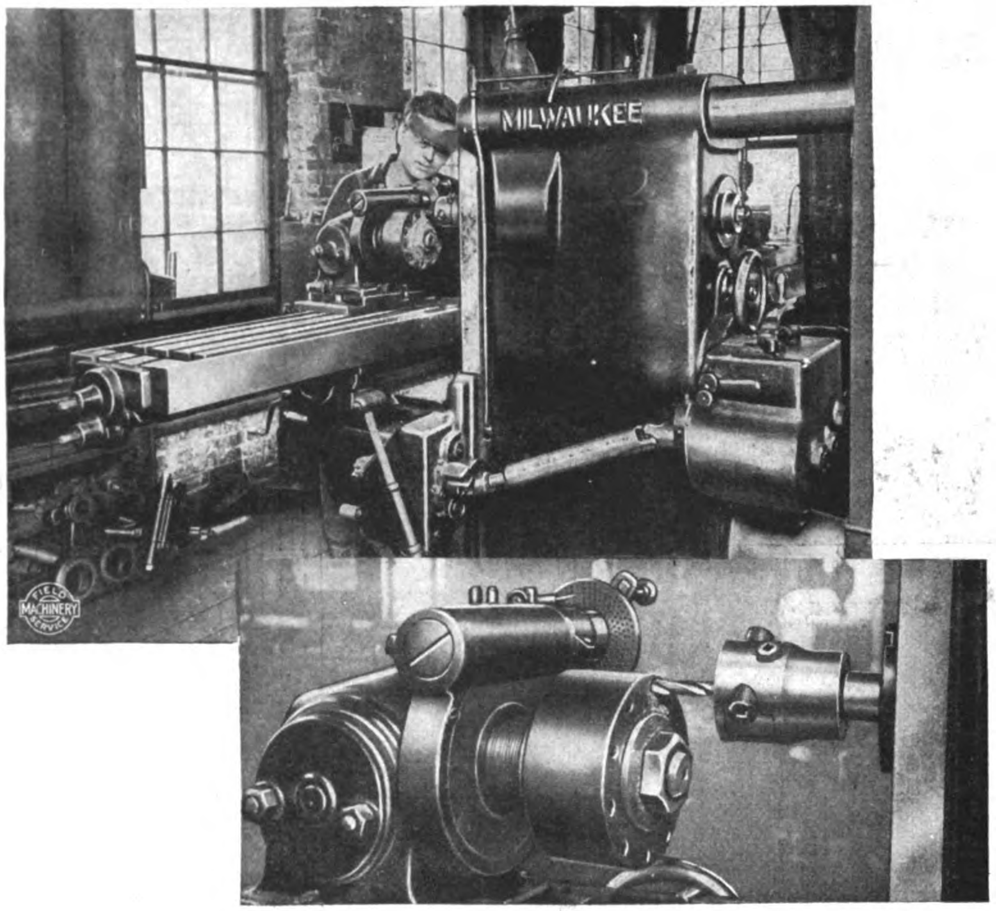
Production: 400 propeller shafts—800 operations in 9-hours, each machine. Let us tell you more about Etna.



THE ETNA MACHINE COMPANY, 3400 Maplewood Ave., Toledo, Ohio

MILWAUKEE MILLING MACHINES

KEARNEY & TRECKER
MILWAUKEE MILLING MACHINES



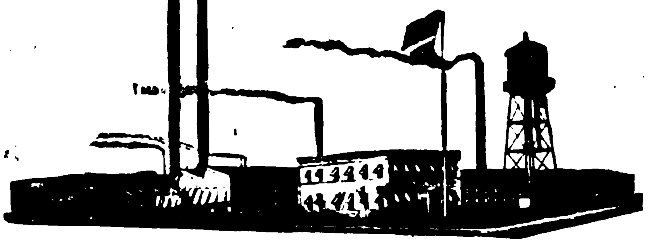
Cost Cutting Equipment for Miscellaneous Work

The above illustration shows a Milwaukee Milling Machine drilling No. 8 taper pin holes in a cutter head 6 in. in diameter mounted on indexing head, in the plant of the Buffalo-Pitts Co., Buffalo

Profitable operation of any shop is largely a matter of fitting the machines to the work. By careful selection of equipment, this progressive concern combines the manufacture of steam rollers with the operation of an efficient contract shop in a most satisfactory manner.

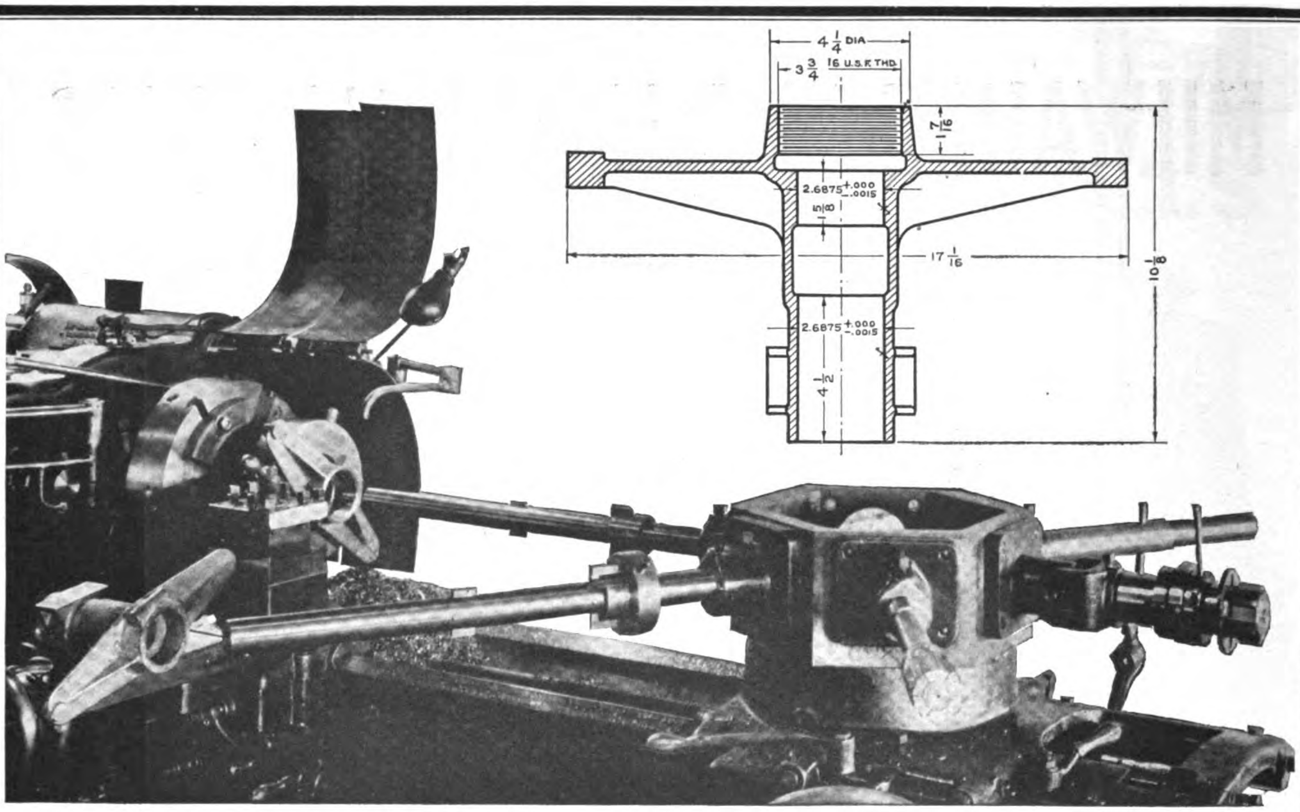
There is plenty of work for the Milwaukee Milling Machine here — work which is handled in a manner that clearly indicates that the best way to reduce production costs is to put the most efficient machine available on the job.

Send for Literature.



KEARNEY & TRECKER
CORPORATION
MILWAUKEE, WIS., U.S.A.

CHICAGO OFFICE 631 WASHINGTON BLVD. | CLEVELAND OFFICE 738 SUPERIOR AVE. N.W. | NEW YORK OFFICE 50 CHURCH STREET


4 1/4 DIA
3 3/4 16 U.S.F. THD.
7/16
2.6875 +.000 -.0015
5/8
17 1/16
10 1/8
2.6875 +.000 -.0015
4 1/2

MULTI-DRILLERS NATCO MULTI-TAPPERS

THE HOLE STORY IN ONE WORD

No. 13 NATCO Tapping Axle Housings in Plant of Timken-Detroit Axle Co., Detroit, Mich.

Size of spindles $1\frac{1}{4}$-in.
Size of taps, $\frac{3}{8}$-in.-16.
No. of holes tapped, 16 each side.
Depth $\frac{7}{16}$-in.
Material, pressed steel.
Speed, 365 R. P. M.
Actual tapping time, 5 sec. each side.
Floor to floor 30 sec.
Production, 120 complete housings per hour.

We design and build jigs and fixtures for use in connection with NATCO Multi-Drillers

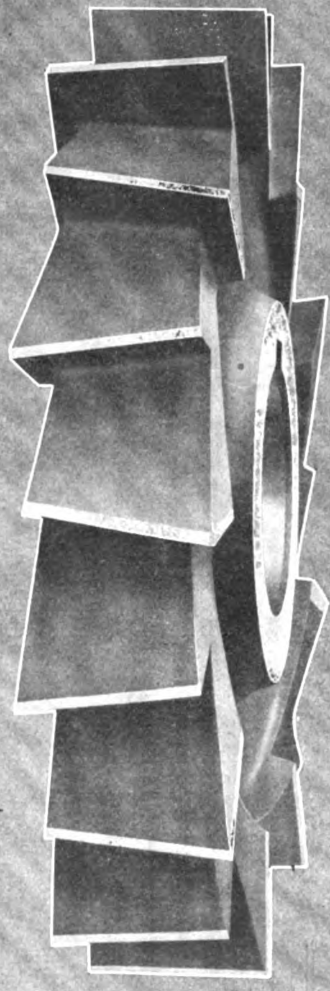
The National Automatic Tool Company

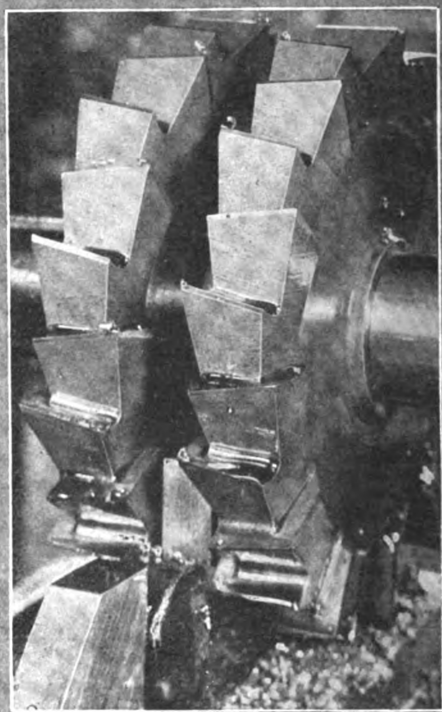
Richmond, Indiana, U. S. A.

BARBER-COLMAN

ALL TYPES MILLING CUTTERS

ACCURATE **DEPENDABLE**





STAGGERED TOOTH CUTTER
MILLING CHANNEL

Milling Channels, Keyways or Slots usually invite several difficulties,—heating of cutter, slow feed, dragging, insufficient chip clearance and poor finish.

Our own shop experience has demonstrated to us that these troubles are more completely overcome by using this Staggered Tooth Cutter than any other, for such work.

STAGGERED TOOTH CUTTER
STRADDLE MILLING

To obtain a smooth finish in Straddle Milling and yet remove the maximum amount of material per minute, the use of this type of Cutter has proved superior.

BARBER-COLMAN COMPANY

HOME OFFICE & PLANT
ROCKFORD, ILL., U.S.A.

102

We Don't Do It That Way

We Rely More on the Machine to Sell Itself Than on the Salesman to Go Out and Sell It

THERE WAS A TIME, not long ago, when the man who had something to sell used cigars, dinners, and good stories to get the name on the dotted line.

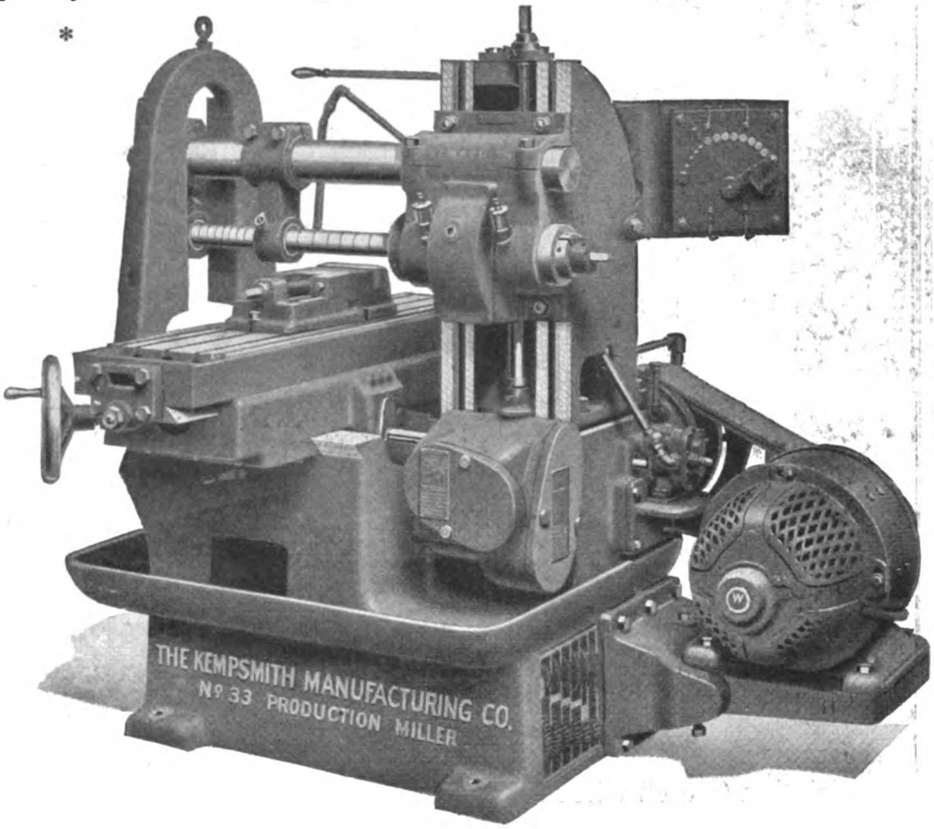
In those days the "drummer" who "made" the small towns down in the shank end of the state, had to be the good fellow with his customers and keep 'em humored. For his customers, or "victims," if you will call them such, were a susceptible bunch. More was sold on personality than on quality.

* * * *

Parallel to this, there is a sales principle among Kempsmith representatives, under which we expect to sell nothing on personality.

So make a mental note of this: Every Kempsmith Milling Machine you see was installed where it is because we have proved its ability to do a certain piece of work better, faster, and more economically.

We sell machines on that basis—not on cigars, dinners and stories.



The Kempsmith No. 33 Production Type Milling Machine.

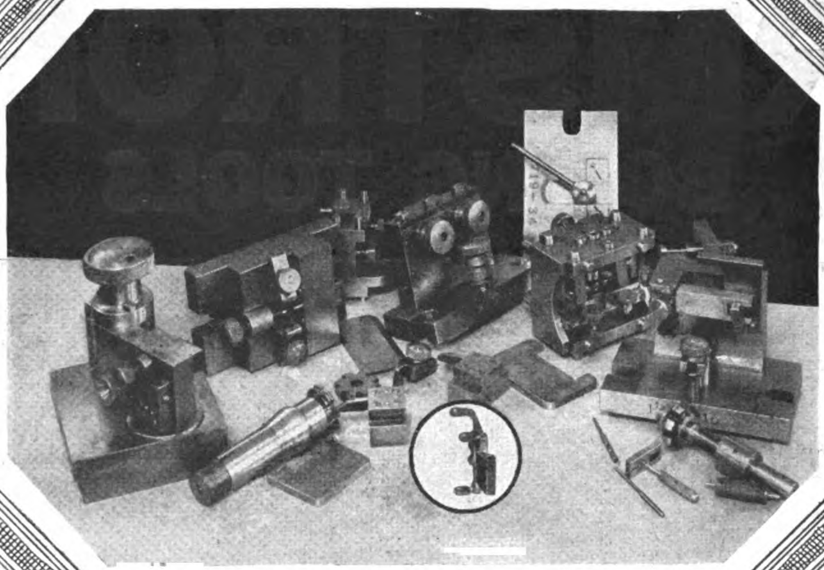
DOMESTIC REPRESENTATIVES:

ATLANTA: Fulton Supply Co.
BALTIMORE: Fairbanks Company
BOSTON: Taylor Machinery Co.
BUFFALO: Homer, Strong & Company, Inc.
CHARLESTON: Cameron & Barkeley Company
CHATTANOOGA: James Supply Company
CHICAGO: The E. L. Essley Machinery Co.
CLEVELAND: Biggs-Waterson Company
COLUMBUS: Osborne & Sexton Machinery Co.
DETROIT: Cadillac Machinery Company
GREENVILLE: Carolina Supply Co.
INDIANAPOLIS: Millholland Sales & Engineering Co.
LOS ANGELES: Smith-Booth-Usher Company
MILWAUKEE: The E. L. Essley Machinery Co.
MINNEAPOLIS: American Machinery Co.
NEW HAVEN: Vandyck Churchill Company
NEW ORLEANS: P. H. McArdle
NEW YORK: Vandyck Churchill Company
PITTSBURGH: Somers, Fitler & Todd Company
PHILADELPHIA: Vandyck Churchill Company
PROVIDENCE: Brownell Machinery Company
RICHMOND: Smith-Courtney Company
ROCHESTER: Homer, Strong & Company, Inc.
SAN FRANCISCO: Fred Ward & Son
SEATTLE: Standard Machinery & Supply Co.
ST. LOUIS: Fairbanks Co. and B. E. Mohr Machinery Co.
SYRACUSE: H. A. Smith Machinery Company
TOLEDO: National Supply Company
TULSA: Fairbanks Co. and B. E. Mohr Machinery Co.

KEMPSMITH

THE KEMPSMITH MFG-CO
MILWAUKEE U S A.

The Maximum in Milling Machines



What's "Under the Hood" of Brown Pyrometers

(2nd of a series)

23 Special Machine Tools to make this Diminutive Bracket

and each cuts to an accuracy of 1/1000"

TO pick it up you'd think it was perhaps made by a master die maker for some very important experimental apparatus. To fit it down over the guide pins that holds it in place, you'd be sure it was.

It is a very fine example of brass die casting, and one of the most difficult ever made. Almost every one of its intricate surfaces and nearly all the holes must be machined to an accuracy of 1/1000", for it carries a movable element as sensitive as "the breath of life" itself. It must keep that element *exactly* centred between the powerful magnet pole-pieces and the soft iron core which are both ground to 1/1000" accuracy.

It is a fair sample of Brown methods all the way through—methods that have produced a pyrometer so advanced, electrically, and so superior in accuracy and durability that there are as many of them in use in America as all other makes combined.

The Brown Instrument Company

Wayne Junction, Philadelphia, Pa., U. S. A.

New York, Pittsburgh, Cleveland, Detroit, Chicago
St. Louis, Denver, Los Angeles, San Francisco, Montreal

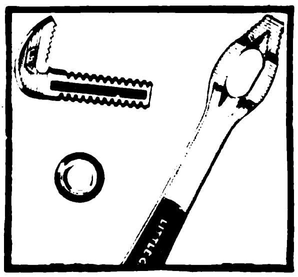
Brown Pyrometers

Most used in the world

Little Giant

Pat. Feb. 4, 1913

Simpler—
Stronger—
Lasts Longer
only 3 parts



ONLY THREE PARTS
Practically Indestructible
(Note teeth on both sides of jaw)

NUTS, rods and pipes are frequently located in almost inaccessible places. When replacements are necessary the man without a *"Little Giant"* Pipe Wrench is sadly handicapped. The *"Little Giant"* grips and lets go quickly and surely, and with it a much greater turn can be accomplished.

In running pipe lines close to walls, ceilings or corners the labor cost is apt to be high. It can be lowered by using the *"Little Giant" Wrench*. The jaw opening can be thrust on to the pipe, rod or nut as easily as a pair of pliers. It grips instantly, gives a far greater turn and requires less muscular effort by reason of the extra long handle.

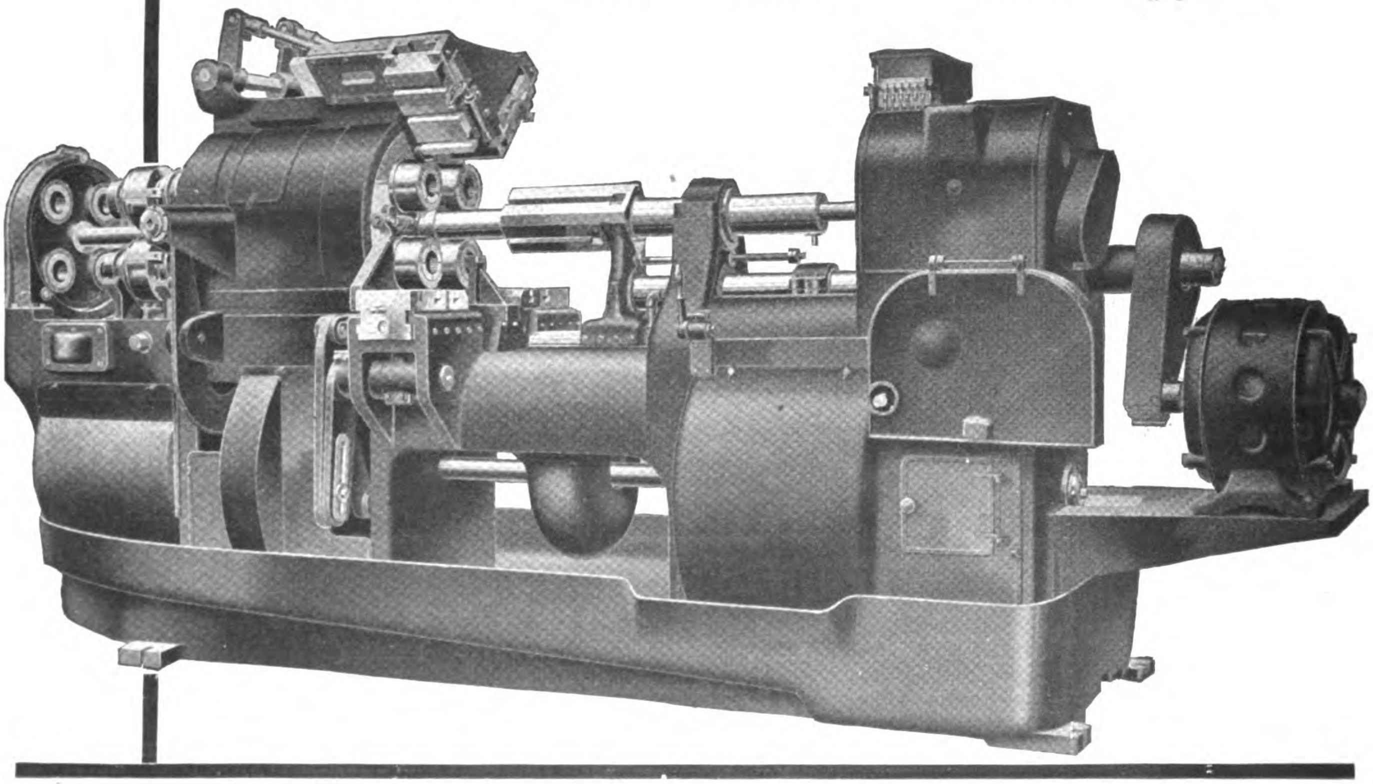
There are but three drop forged hardened steel parts in the *"Little Giant."* It has two to four times the service life due to extra sets of teeth.

Hundreds of users have written us enthusiastic letters concerning *"Little Giant"* performance. You'll add your name to their number once you see it in action.

GREENFIELD TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS

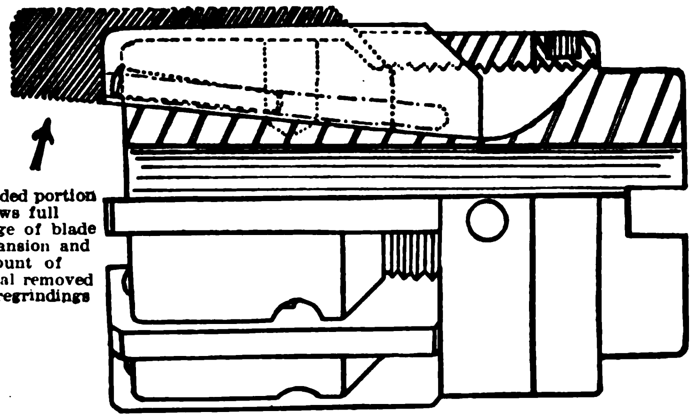
Canadian Plant: Greenfield Tap & Die Corporation of Canada, Limited, Galt, Ont.
London Office: Greenfield Tap & Die Corp., 139 Queen Victoria St., London E. C. 4.

GTD Screw Plates, Taps, Dies, Reamers, Gages, Pipe Tools, Twist Drills, Milling Cutters



Davis Expansion Reamers

Patented 1912



Shaded portion shows full range of blade expansion and amount of metal removed in regrindings

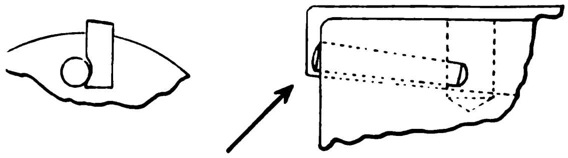
Principle of Blade Expansion Forward on Taper

The entire principle of expansion is simple, practical and effiefficient. Davis Expansion Reamers were the first to employ the forward movement of blades, in tapered slots, when expanding diameter—a feature, originated by the Davis Boring Tool Company and clearly set forth in their Letters Patent. This is a distinct advantage, which insures perfect bottoming at all times, with blades always extended and cutting in advance of the reamer body.

Other Advantages That Insure Economy

Greatest economy in reaming costs is assured with Davis Expansion Reamers. Uniform expansion of blades, forward on taper, produces accurate adjustment to size in a few seconds, without circular grinding. The liberal range of expansion, with maximum utility of blades and blades interchangeable in various size reamers, are all important factors that should be fully considered in deciding on the most economical reamer.

Patented Blade Clamping



Blades Always Extended in Advance of Reamer Body

The practical method of holding the blades in a reamer with hardened taper pins is an exclusive patented feature that reduces time in adjusting to the minimum. No troublesome, individual blade screws to loosen and retighten in adjusting to size.

Taper Pins Have 100 Times the Holding Power of Screws

These hardened taper pins are accurately fitted to reamer body with perfect line contact only, in blade groove for entire length of pin; thus permitting quick adjustment to exact size without removing or disturbing the pins.

Davis Expansion Reamers are universal tools—adaptable in all shops, large or small. Made in three distinct types and in stock sizes to meet your own individual requirements.

Maintain 100% efficiency by standardizing your shop throughout with Davis Expansion Reamers. Write for our circular No. M-520 for full information.

Davis Boring Tool Company

Incorporated

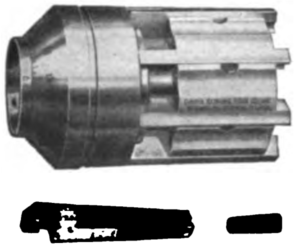
3706-24 Forest Park Boulevard

ST. LOUIS, MO.

Established 1903

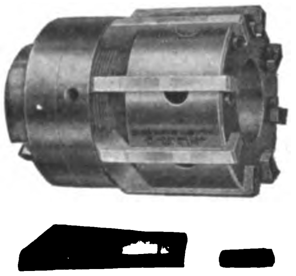
Largest Exclusive Manufacturers of Expansion Boring Tools and Expansion Reamers

SHELL TYPE



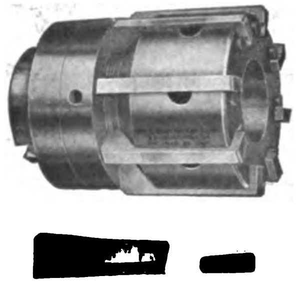
Group I—No. 540.

A reamer of the highest quality, possessing many exclusive features and advantages that guarantee its efficiency. Has a micrometer adjusting dial, graduated in ¼ thousandths insuring greatest accuracy.



Group II—No. 550.

An efficient, dependable production reamer designed for shops where a moderate priced reamer is desired, to maintain a uniform production.



Group III—No. 560.

Shops with only limited requirements will find this reamer especially adaptable. An inexpensive reamer, easy to adjust and to operate.

WE SUPPLY THE WORLD WITH EXPANSION BORING TOOLS AND EXPANSION REAMERS

MONARCH MACHINE TOOL CO.
MONARCH ENGINE LATHES
SIDNEY, OHIO

(Trade Mark Registered)

If the Engine Lathes you buy bear this trade mark you are assured of the utmost in lathe value and you are guaranteed complete satisfaction in their use.

We Guarantee Every Monarch Lathe to Give Complete Satisfaction to the Purchaser

Could Any Guarantee Be Stronger?

This is the guarantee that covers every Monarch Lathe we sell.

If among the many thousands of users of Monarch Lathes there are any who are justly dissatisfied with their Monarch Lathes, we urge them to give us the opportunity of making good the Monarch Guarantee.

When you buy a Monarch Lathe you get guaranteed Lathe satisfaction at minimum cost.

The Monarch Machine Tool Co.

107 Oak Street, Sidney, Ohio

AGENTS:

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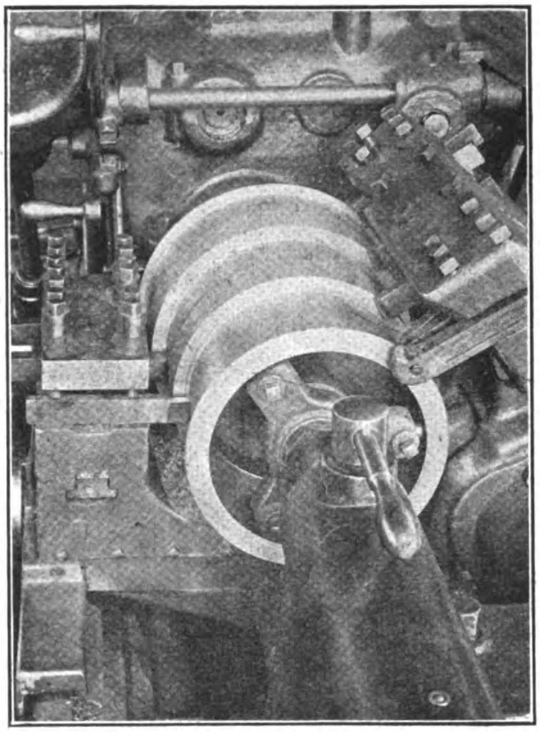
The FAY AUTOMATIC Way—



A three-step cone pulley is completely machined in the time it takes to turn one step

The Pulley shown in the photograph is a 3-Step Flange Pulley being done in the plant of the Fellows Gear Shaper Co., Springfield, Vermont.

The superintendent tells us that this is the most satisfactory machine that he has ever had on this kind of work.

All turning and facing cuts are taken simultaneously. The back arm rocks in as the front carriage moves forward.

Observe the multiple tooling.

All roughing and finishing cuts are taken simultaneously—two machines, one operator.

All crowned faces are turned by regular mechanism of machine —no special attachments are needed.

Especial attention is called to the size of the work, requiring great pulling power on the part of the machine. The largest step is 12 in. diameter. The widest face is 3⅜ in. PRODUCTION IS SIX 3-STEP PULLEYS PER HOUR.

This is only one of the many jobs that can be done profitably on the Fay Automatic Lathe.

Write for details

Jones & Lamson Machine Co.

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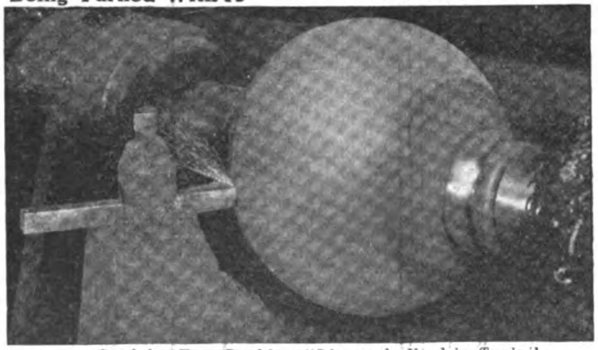
9-10 Water Lane, Queen Victoria St., London, England

France, Spain and Belgium—F. Auberty & Co., 182 Rue Lafayette, Paris. Holland—Spliethoff, Beeuwkes & Co., Leuvehaven, wz. 159 Rotterdam, Japan, Korea, etc., Mitsui & Co., Ltd., Tokio. Australasia—McPherson's Pty., Ltd., 554 Collins St., Melbourne, Sweden—A. Bol. Oscar Lindbom, Stockholm—Post Box 420.

This Bowling Ball Is Being Turned With A **DIAMOND**



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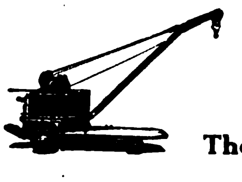
ARTHUR A. CRAFTS & CO.
125 Summer St., Boston, Mass.

DIAMOND TOOLS

hold their cutting edges for months. Can easily be sharpened and will last for years. Leave a smooth, true and finished surface. These special shaped carbon, black diamond, pointed tools are best for turning paper, cotton, corn husk, rag, fibre, hard rubber, etc. They turn out a large number of pieces of exact uniform size.

THOS. L. DICKINSON
38 Gold Street New York
Successor to John Dickinson. Estab. 1796



Ready to Save the Cost of Wasteful Hand Trucking

Request Catalog 811.

The Elwell-Parker Electric Co.
Cleveland, Ohio

Rockwood Pressed Steel
MACHINE HANDLES

Rockwood Pressed Steel Machine Handles are designed to fit the hand. They are strong yet light and well balanced. Equip all your levers and hand wheels with Rockwood Handles and improve their appearance and efficiency. Eleven sizes to select from. Samples and prices to those interested.

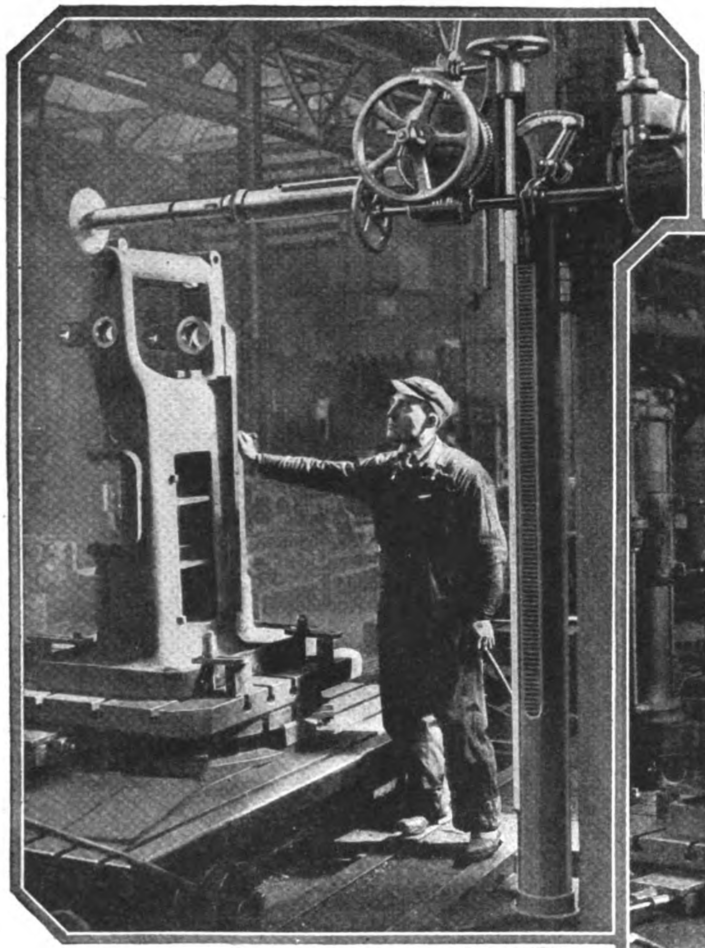
Rockwood Sprinkler Co. of Massachusetts
General Manufacturers of Pressed Steel Products
Worcester, Mass.

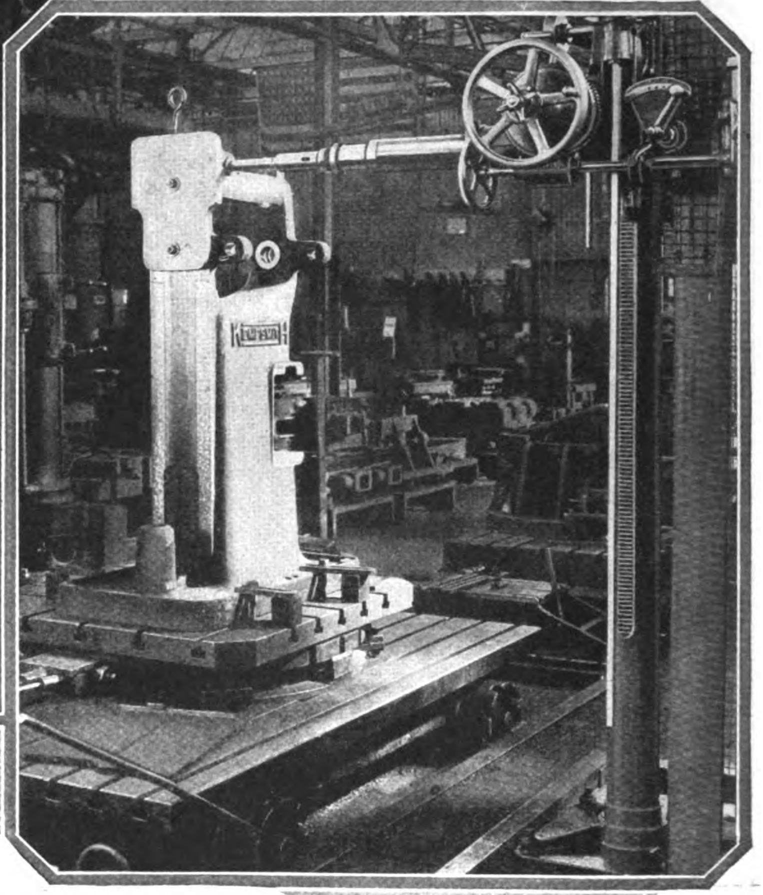
S-p-e-e-d

That's its middle name. In fact, you can't make this drill "smoke" even though it leaves other portables far behind. Workmen prefer a "STANDARD" Portable Electric Drill because it is light, balanced beautifully and ball bearing in both armature and gears. Takes either current.

Catalog?

THE **STANDARD** ELECTRIC TOOL CO.
Cincinnati, Ohio





Can You Match This Performance in Your Shop?

One set-up on the 4-ft. turn table and the frame shown above is drilled, bored, reamed, tapped, faced, back-faced and slotted from 4 positions—with the P & H Horizontal Drilling and Boring Machine.

All the operations listed below, from the time the frame is clamped to turn table until it is finished and placed on the floor required but 90 *minutes*.

Bore and Ream, 1 hole, 1½" through 5⅜" metal faced and back-faced.
Drill, 1 hole, ¾"—1¾" metal.
Drill and Tap, 1 hole, ¾"—1¾" metal.
Drill, 1 hole, 7/16"—1½" metal.
Drill, 1 hole, ¾"—1½" metal.
Drill and Tap, 2 holes, ⅜"—1" metal.
Drill, 1 hole, 11/32"—¾" metal.

Drill and Tap, 6 holes, ½"—1½" metal.
Drill and Tap, 2 holes, 7/16"—1¼" metal.
Drill and Tap, 1 hole, ½"—2" metal.
Drill and Tap, 3 holes, ⅝"—⅝" metal.
Drill, 1 hole, 11/32"—½" metal.
Milling, ⅛" slot through 2" metal, 4" long.

Where can you put a machine of this kind to profitable use in your plant? Bulletin 214 which contains detailed information will be sent on request.

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Established in 1884
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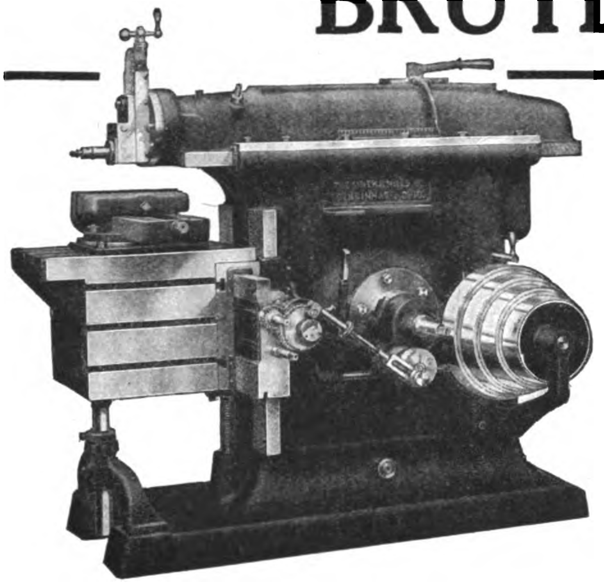
DRILLING & BORING MACHINES

BRUTE STRENGTH!



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All the knowledge of engineering and metallurgical science has gone to the building of:

S & M Shapers

Our 34 years' experience has enabled us to produce a machine having many interesting new features.
For instance, the helical cut Bull Wheel and Pinion, generated on a Fellows Gear. The screw-like motion is smoother, quieter and more effective than any other.

We can save you money.
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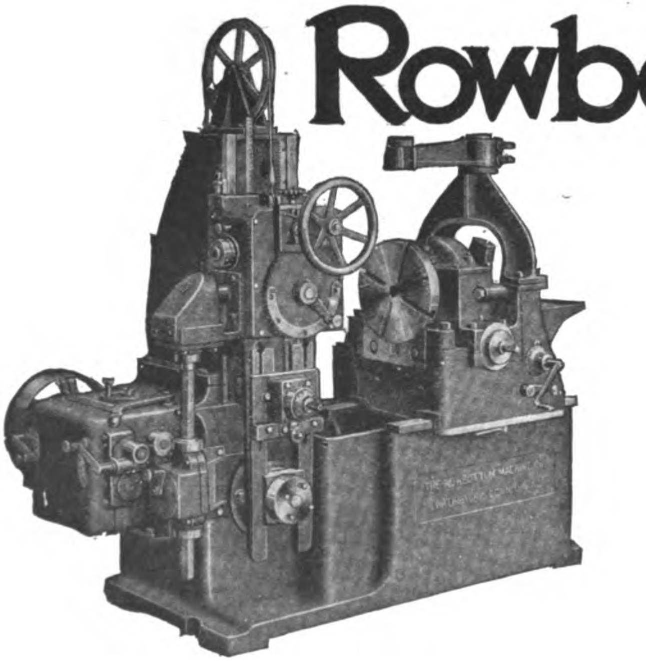
Taking Up The Slack

Machines incorporating cam movements are sometimes faulty in operation. The slackness and jerkiness, in the majority of cases, is due to poorly finished cams. You can insure unvarying smoothness in your product by going to

Rowbottom for Cams



The **Rowbottom Universal Cam Milling Machine** cuts all styles of cams in general use to the closest specifications. No special attachments are necessary.

If you feel your cam needs do not warrant the installation of a machine you can still enjoy the benefits from using **Rowbottom Cams** because we cut them right in our own shops for a large list of cam users.

Let us mail you some interesting cam data.

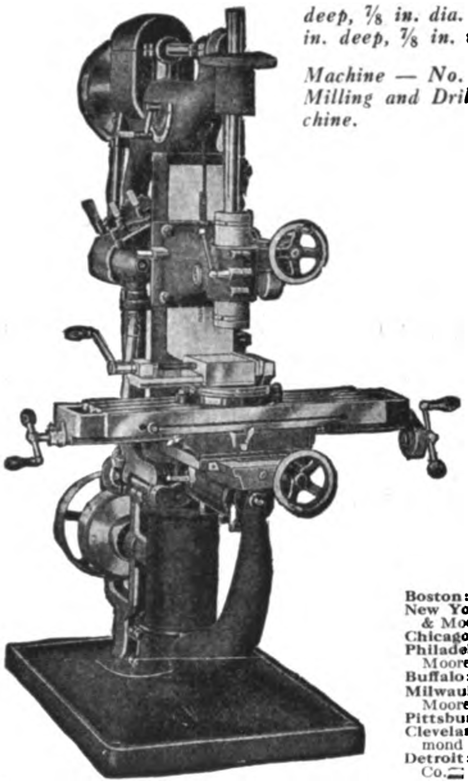
We can assure complete satisfaction either way.

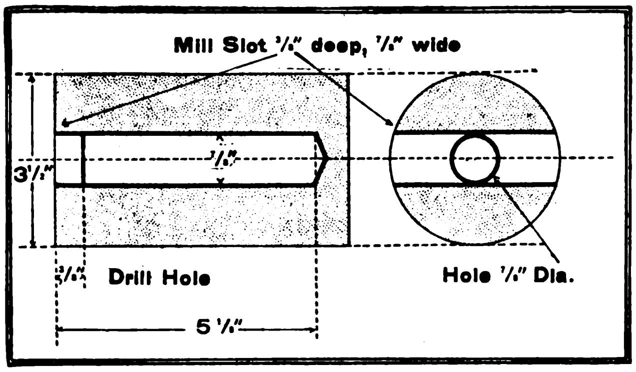
The Rowbottom Machine Co.
Waterbury, Conn., U. S. A.
Factory: Waterville, Conn.

The Knight Milling *and* Drilling Machine

Piece—locating plug, Material—tool steel. Operations: Drill hole 5½ in. deep, ⅞ in. dia. Slot, ⅜ in. deep, ⅞ in. wide.

Machine — No. 2 Knight Milling and Drilling Machine.





The Job Completed in One Setting

It is a very simple matter to do work of this kind on a Knight Milling and Drilling Machine without removing the piece from the table.

This is a specimen of a job which is being done by the Northway Motor & Mfg. Corp'n., at Detroit.

The Knight Milling and Drilling Machine is versatile. The table can be tilted to practically any angle in the circle, rigidly clamped, and milling or drilling operations completed without disturbing the original setting.

W. B. Knight Machinery Company, **3920 West Pine Blvd. St. Louis, Mo., U. S. A.**

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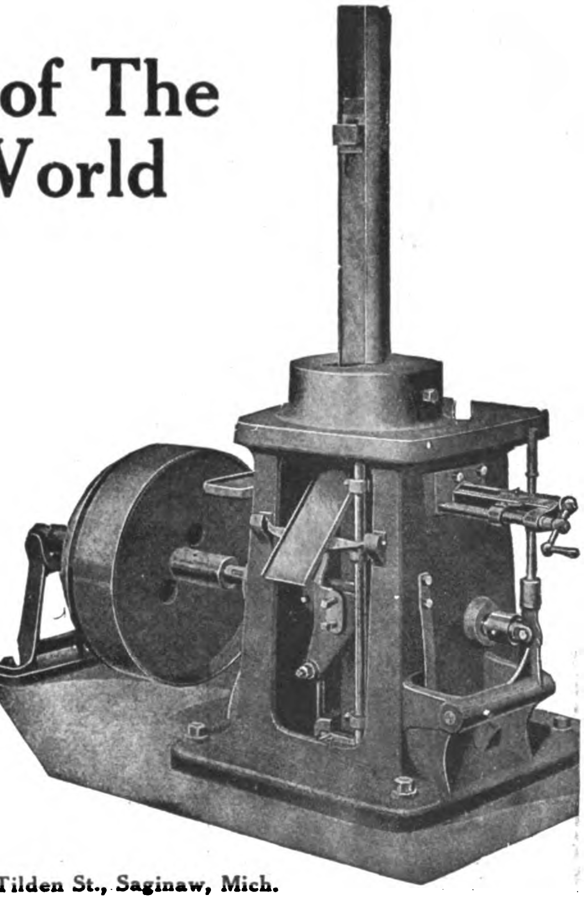
The "Speedster" of The Machine Tool World



Here is a keyseater of unquestionable quality and accuracy which will handle your jobs—large and small alike—with unusual speed.

Practically any size or shape keyseat, straight or tapered, can be cut with the greatest of ease. There are few machines which can equal the **GIANT** in range.

Set-ups are a matter of seconds, no clamps being needed to hold the work to the table. The "pull down" of the cutter bar prevents slipping and chatter.

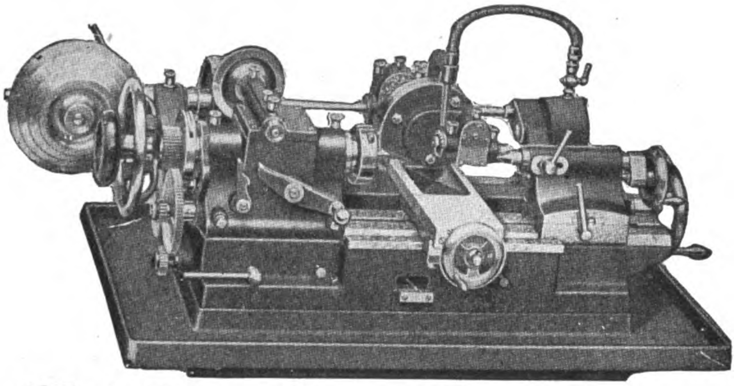
May we show you how the **GIANT** will cut operating costs in YOUR shop? Our Engineering Staff will furnish you with guaranteed estimates on your own work.

Write for our Catalog.

Let us show you what the GIANT will do on your work

MITTS & MERRILL CO. **913 Tilden St., Saginaw, Mich.**

One or a Carload



Waltham

Thread Miller

Whether or not you require one good threaded part or a carload, the **Waltham Thread Miller** will do the job quickly, economically and correctly.

Interchangeability created the need for more accurate screw threads, thus the necessity for the **Waltham.** Simplicity is one of its main factors.

After being set up the **Waltham** requires nothing but power to keep it turning out quality parts. One man—not skilled—can attend several machines, and this adds profit to every threaded part produced.

The Waltham has a capacity for work 7¼ in. long and any diameter up to 3 inches. Sixteen different feeds are available and it is thus adapted to your most exacting requirements. It is best adapted for work 2 inches in diameter and smaller.

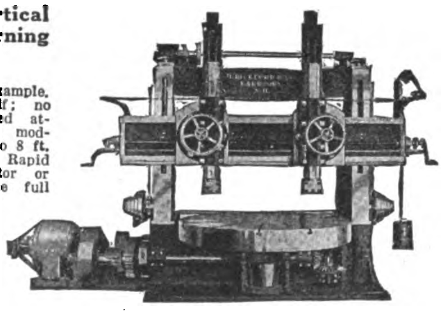
Ask us for details.

Waltham Machine Works, High Street, Waltham, Mass.

Vertical Boring and Turning Mills

handle a wide variety of work not expedient or possible on other machines—particularly the unusual, the irregular.

BICKFORD Vertical Boring and Turning Mill



is a finely developed example. Complete within itself; no costly and seldom-used attachments, therefore moderately priced. 4 ft. to 8 ft. Single or double heads. Rapid power traverse. Motor or belt driven. Get the full catalog description.

H. Bickford & Co.

Lakeport, N. H. U.S.A.

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12-14-16-Single Geared
16-20-Back Geared
26-in. Combined Open Side Crank Planer and Shaper

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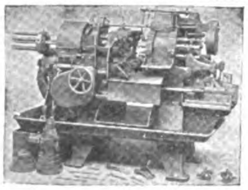
High Duty Shapers and Automatic Gear Cutting Machinery

GOULD & EBERHARDT

"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY
ESTABLISHED 1833 NEWARK, N.J. U.S.A. CHANCELLOR AVE.

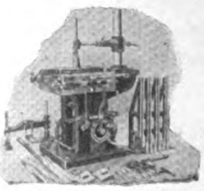
CINCINNATI 5-Spindle AUTOMATIC Screw Machine



No Special Cams Needed. Uniform feed. For jobbing as well as long runs.

Cincinnati Automatic Machine Co.
Cincinnati, U. S. A.

MORTON STATIONARY KEYSEATER



This type of keyseater is designed to meet the requirements found in shops where any keyseating is required.

It is equipped with automatic feed, which is so designed that it relieves the cutter on the upward stroke, and can be set to cut keyways of required depth. No further adjustment required to cut similar keyways in other hubs. Cutter feeds up to the work. Machine runs as easily on large jobs as on small.

Ask for Bulletin No. C-1.

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For screw machine economy, accuracy and big output

4 Sizes—Get Catalog

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CONE AUTOMATICS

A New Way to Mill Threads

Hall Planetary Thread Millers

Reduces threading cost 50% on some classes of work. Cuts all style threads internal or external.

Write for particulars

THE HALL PLANETARY THREAD MILLING MACHINE CO.,
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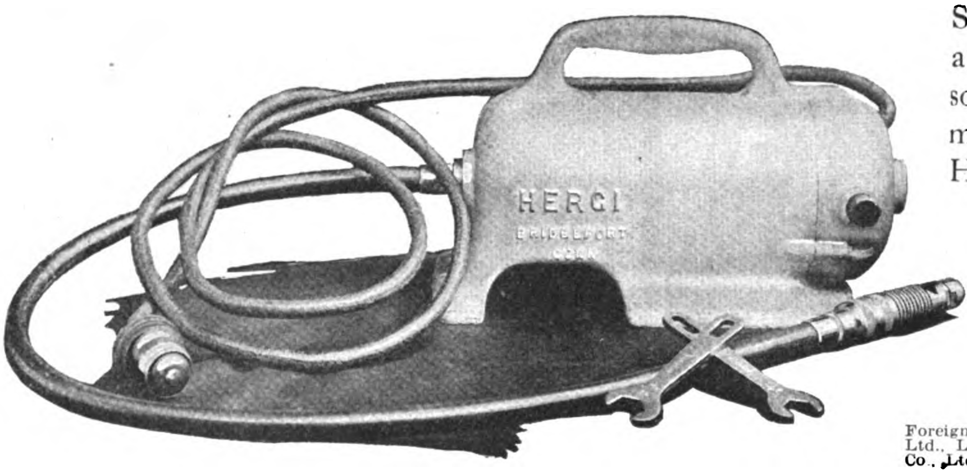
Announcing the New $65 HERGI H-250

The Ideal Motor-Driven, Flexible Shaft Outfit for Pattern Makers, Tool Makers, Die Makers, Machinists, etc.

Has a 1/6 h.p. universal motor, enclosed in an aluminum case. For easy handling, the base and handle are made in one piece. A ventilating fan keeps the motor and bearings cool at all times. This insures long life.

Six feet of drop cord with attachment plug is provided with each outfit. The handpiece is our patented ball-bearing type.

We have long specilized in Flexible Shaft Equipment, and you can rely absolutely on this new model — the $65 HERGI H-250.



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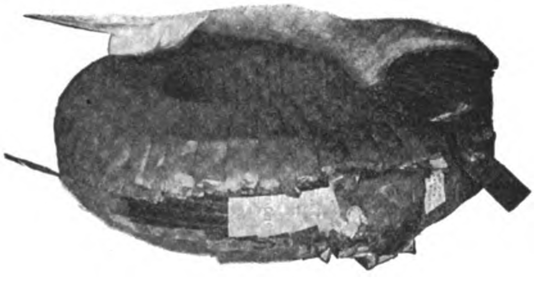
HERGI MFG. CO.
5th St., Bridgeport, Conn.

Foreign Agents: Goodchild & Partners, Ltd., London, England; Atlantic Baltic Co., Ltd., Copenhagen, Denmark.

TRADE · SIMCORE · MARK



Smooth finish
Easy to pull in
Safe and Satisfactory
Quick delivery

SIMPLEX WIRE & CABLE Co
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Strand
Type M P 5

¼-hp. Motor

Originators and Manufactures

We Make Flexible Shafts and Equipments in Several Sizes and for Many Purposes

This Type
MP5
is a splendid outfit for the Metal Pattern Maker and for general use in the Machine Shop or Tool Room.

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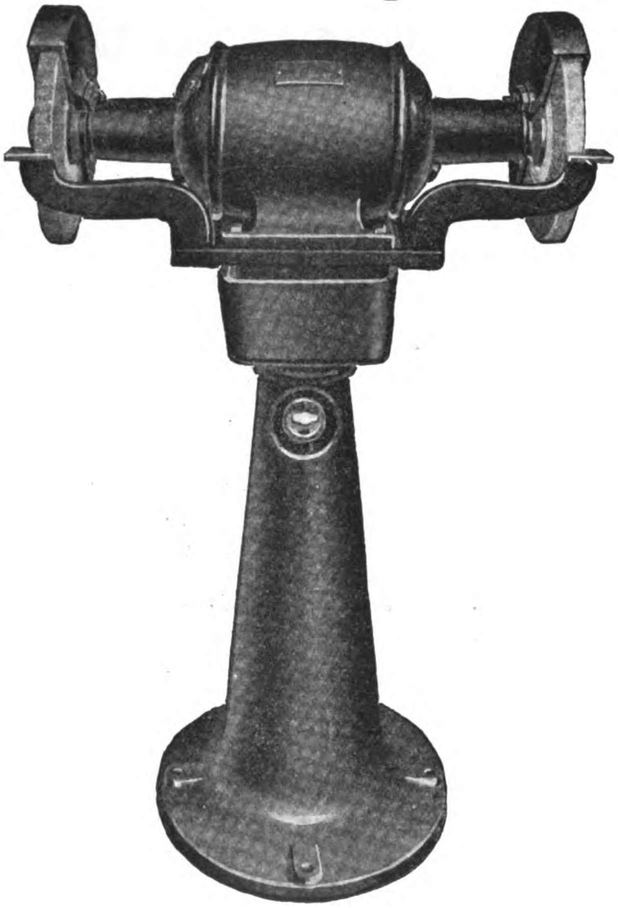
N. A. STRAND & CO.
625 W. Jackson Blvd., CHICAGO

NO DUST

After Five Years' Continuous Running



In no department is dust-proof machinery more important than in the grinding and buffing room. Here the conditions require that the machinery be absolutely dust-proof when it is installed and that it remain so indefinitely.

"DILLON"

Electric Grinders and Buffers

have been opened up and examined after FIVE YEARS of continuous service without showing a trace of dust. When you figure it out, the "DILLON" design makes dust gathering impossible. The totally enclosed motor and the absence of gauze-covered port holes make free, clean running a certainty.

The dust-proof feature alone is proof of "Dillon" superiority; but there are other points of advantage too.

Our bulletins tell about them

The Dillon Electric Co.
Canton, Ohio, U. S. A.

For Etching, Demagnetizing, Soldering and Annealing
The

Luma
ELECTRIC EQUIPMENT CO.
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is a wonderfully efficient and simple instrument that will save its cost from a dozen angles. It plainly and easily marks new, and resized tools, demagnetizes cutters, parallels and like parts that have been used with magnetic chucks, spot anneals thin steel and handles many soldering jobs.
The LUMA is readily portable and takes its power from your lighting circuit. Get full details.

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Running Hot or Boiling Water Instantly at Low Cost

Easily attached to any water faucet and with this Instantaneous Electric Water Heater you get clean sterilized hot or boiling running water right out of the faucet, all day if you desire. Cold water out of the same faucet by just a turn of the handle. Can be operated on either direct or alternating current.

Convenient in the shop for washing the grease or dirt off your hands or instantaneous sterilized water for first aid rooms.

4000 in daily use—Write to-day for descriptive matter and prices.

Bridgeport Machine & Tool Mfg. Co., Inc.
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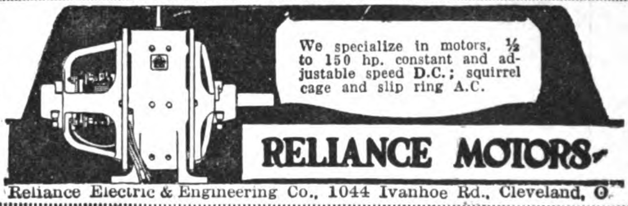

We specialize in motors, ½ to 150 hp. constant and adjustable speed D.C.; squirrel cage and slip ring A.C.

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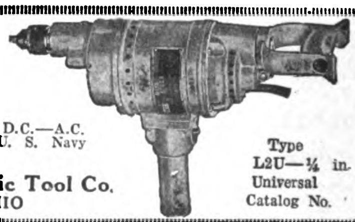
Portable Electric

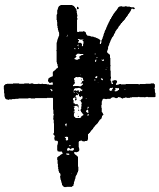
Drills and Grinders



Complete line of sizes suitable for D.C.—A.C. and Universal current tested to U. S. Navy requirements.

Type L2U—¼ in. Universal Catalog No.

The Neil & Smith Electric Tool Co.
CINCINNATI, OHIO



The Pioneer Portable

ELECTRIC DRILLS

All styles and sizes **and Grinders**

Louisville Electric Mfg. Co.
Incorporated
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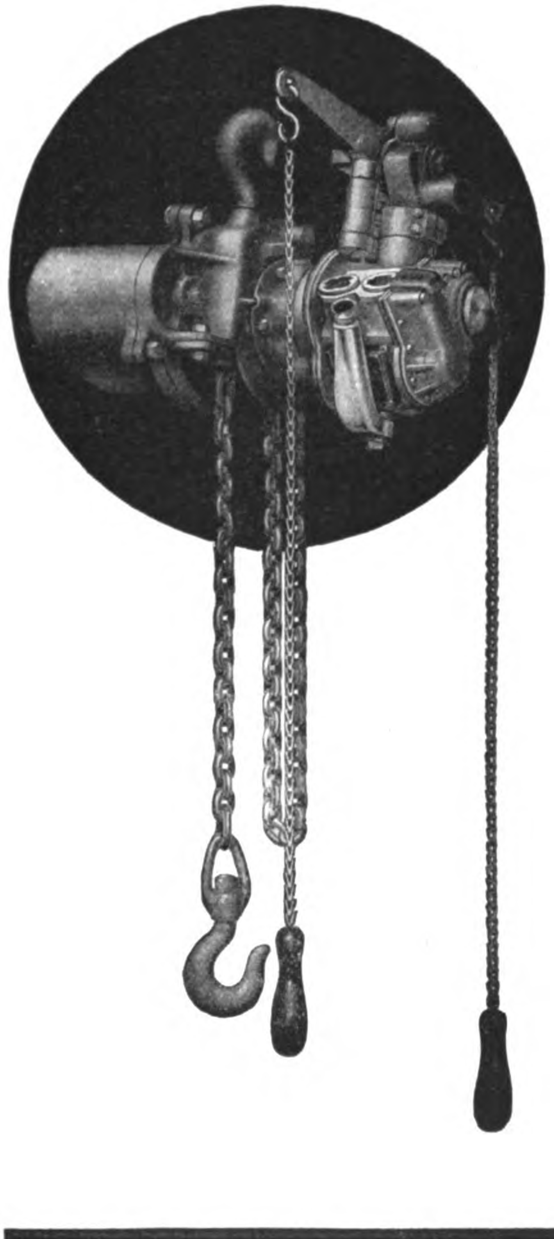
NEW!



—*a Little Giant Combination Air Hoist*

COMBINING the popular, speedy and powerful Little Giant Air Drill motor and the half-ton "Cyclone" chain hoist, this Little Giant Combination Air Hoist speeds up and economizes numerous lifting operations.

It combines light weight, 750 pounds lifting capacity at speeds of 22½ and 30 feet per min.; smooth, positive operation; easy control, and sturdy, wear-resisting parts.

It requires lubrication only twice weekly because it embodies two exclusive features — Invincible One-Piece Interchangeable Toggles and Improved Oiling Device.

The foregoing features especially adapt this Little Giant for the exacting conditions encountered in foundry service, assembly rooms of machine shops, lathe, planer and drill press service; handling pickling tanks, ashes, wire from soaking pits, and scores of other lifting jobs.

Hoist *pneumatically* with Little Giants!

Complete details upon request.

Chicago Pneumatic Tool Company
Chicago Pneumatic Building • 6 East 44th Street • New York
Sales and Service Branches all over the World

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BOYER PNEUMATIC HAMMERS · · LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
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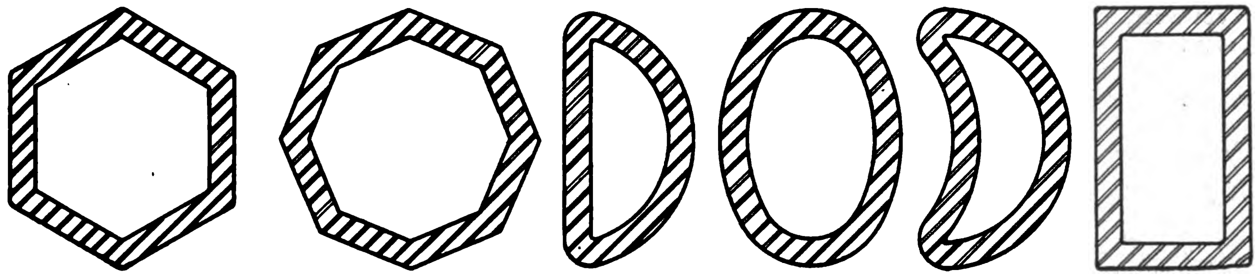
Special Shapes in Seamless Mechanical Tubing



THE special shapes in which "SHELBY" Mechanical Tubing is manufactured, not only solve many problems of machining and fabrication but make it possible to construct numerous articles which could not be made from other materials with the same economy or to the same advantage.

The illustrations give an idea of the possibilities in saving time, tools and labor by using various shapes instead of unnecessary grinding and finishing round tubing to size and shape. Wherever practical to use this specially formed tubing, the constructions are characterized by lightness of weight and absence of bulk, while having ample strength and serviceability.

"SHELBY" Seamless Mechanical Tubing is made in a wide range of shapes, sizes, wall thicknesses, weights, various kinds of steel and different anneals —to meet practically any requirement.

Ask for Booklet—"SHELBY" SEAMLESS STEEL TUBES AND THEIR MAKING. Free on request.

NATIONAL TUBE COMPANY, PITTSBURGH, PA.

General Sales Offices: Frick Building

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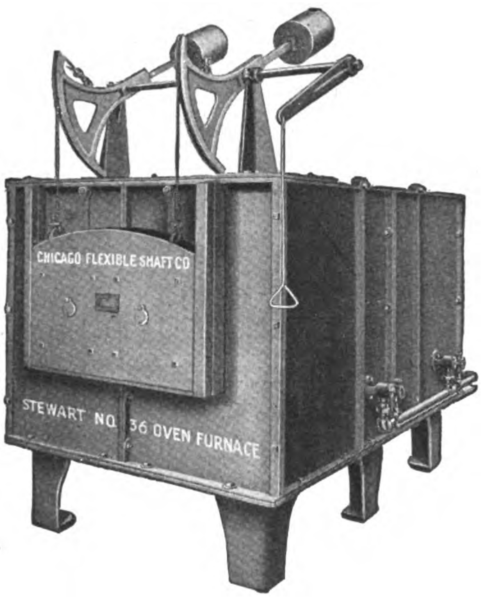
STEWART



A Rugged Carburizing Furnace for Regular He-Man Jobs

The Stewart No. 36 embodies utmost strength and solidity in design and construction.

It is in wide use for carburizing and annealing, and is large enough to receive and hold carburizing boxes and annealing pots of the larger sizes, and to handle heavy and long work.

SPECIFICATIONS:

Opening, 20 in. x 36 in.; depth, 72 in.
Floor space, 68 in. x 94 in.
For gas or oil fuel.
Gas and air connections, 2 in.
Oil connections, ½ in.
Shipping weight, 12,000 lbs.

This furnace has proven its efficiency, not only from the standpoint of quality production, but from the quality and accuracy of the work done in it.

Write for Bulletin No. 2, completely describing Stewart Furnaces for heat treating, carburizing, annealing, etc.

Chicago Flexible Shaft Company

1156 S. Central Ave., Chicago

16 Reade Street, New York — 420 Wainwright Bldg., St. Louis — 608 Kerr Bldg., Detroit
305 Merchants Bank Bldg., Indianapolis

STEWART

High Speed Big Capacity Melting Furnace

No. 300

Three JOHNSON

Powerful Patented Direct Jet Bunsen Burners produce the heat with only a gas consumption of 40 cu. ft. per hour. *No forced air blast or blower required,* needs only a gas connection to install and always ready to go.

Furnace stands 28 in. in height, has removable cast iron Melting Pot which has a capacity of 150 lb. of soft metal.

Write for descriptive literature.

JOHNSON GAS APPLIANCE Co.
Cedar Rapids IOWA

PIPE THREADING AND CUTTING MACHINERY

All Sizes ⅛ to 18 in. inclusive

D. Saunders Sons, Inc., Yonkers, N. Y

Catalogue on request

HEAT TREATING FURNACES

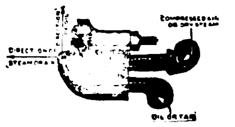
Oil and Combination Burners
Tanks—Pumps—Compressors—Blowers

ADVANCE FURNACE & ENGINEERING CO.
Springfield, Mass.

Boston — New York — Philadelphia — St. Louis — Pittsburgh

There is nothing better than the Best

To secure 100% Economy and 100% Efficiency, use W. N. Best oil and tar burners and furnaces for Annealing, Case Hardening, Tempering, Forging, Heat Treating, etc. Send for Catalog.



"There is nothing better than the Best"

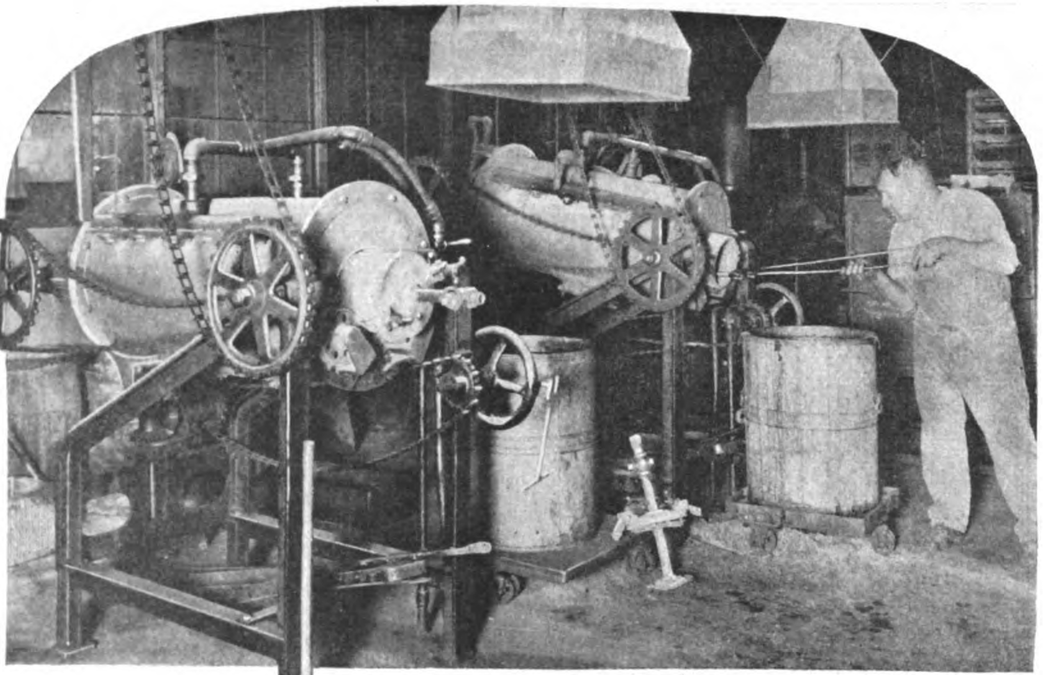
W. N. Best Furnace & Burner Corp., 11 Broadway, N. Y. City

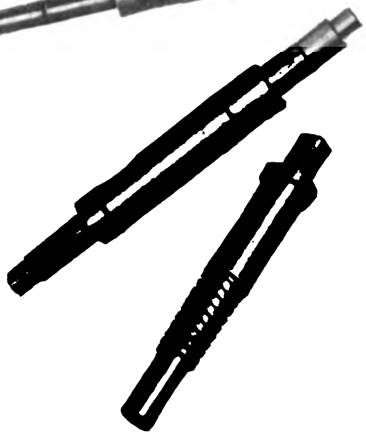
SALES AGENTS AND ENGINEERS

Representing a large number of manufacturers contracting through one organization for all types of industrial furnaces. *Centralized responsibility for overall plant results.*

Out of Flame—Progress

American Industrial Furnace Corp.
10 Post Office Sq., Boston, Mass.





Cut carbonizing time *one-third*

That is what the American Gas Furnace Co., Carbonizing Furnaces have accomplished for the Bijur Motor Co., of Hoboken, N. J. on the carbonizing of motor and aeroplane parts.

This rapid carbonizing is of particular value in view of the fact that it has invariably been accompanied by extreme uniformity of hardness so essential to small running parts.

The Bijur Motor Co., states that the design of these furnaces is excellent for their purposes and that their service is very satisfactory. They started using American Gas Furnaces about six years ago and today have probably as complete an installation as can be found.

"AMERICAN" engineers, pioneers for over 40 years in this field, have led the way, not only in the application of "volatile carbon," but in every type of modern heat-treating. Let us show you how "AMERICAN GAS" equipment is applied to your own manufacturing problem to produce faster and more uniform results by our more than 40 years' experience.

AMERICAN GAS FURNACE CO.

Main Office and Works, Elizabeth, N. J.

American Gas Furnace Products Include:

- Automatic Temperature Controllers
- Automatic Quenching Tanks
- Blowers
- Blowpipes or Blowtorches Hand and Stand
- Boosters, Gas
- Brass Melters
- Brazing Furnaces and Tables
- Burners
- Burners for Electric Lamp Bulb Manufacture
- Carbonizing Machines
- Cyanide Furnaces
- Cylindrical Furnaces
- Forges
- Forges, Glass Bending
- Hardening Hammers
- Heating Machines
- Melting Furnaces
- Muffle Furnaces
- Oil Tempering Furnaces
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- Rivet Heaters
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- Sweep Reducing Furnaces
- Tempering Plates
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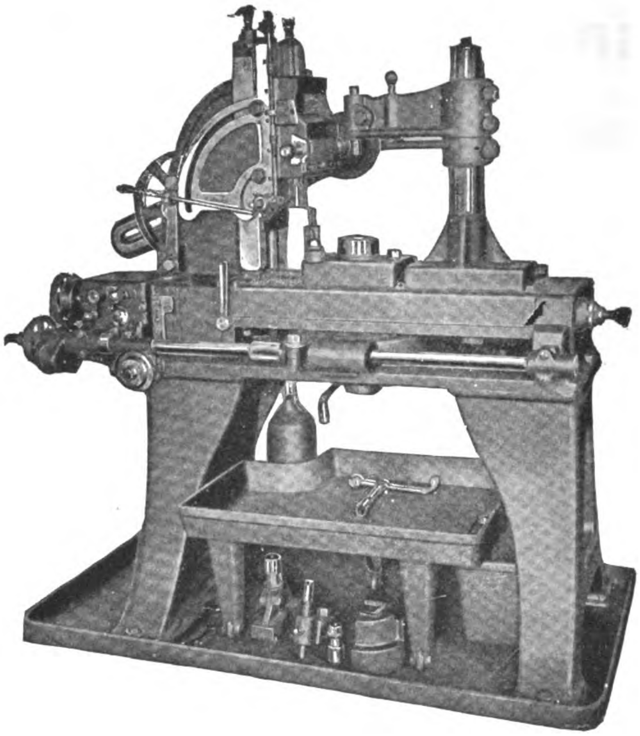
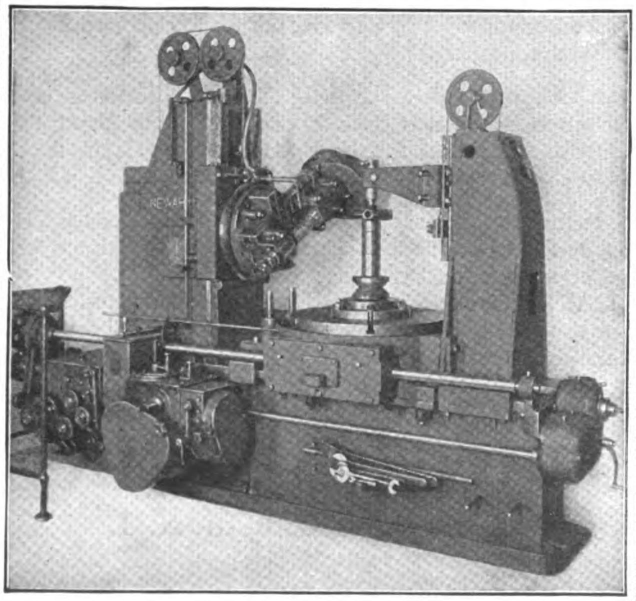
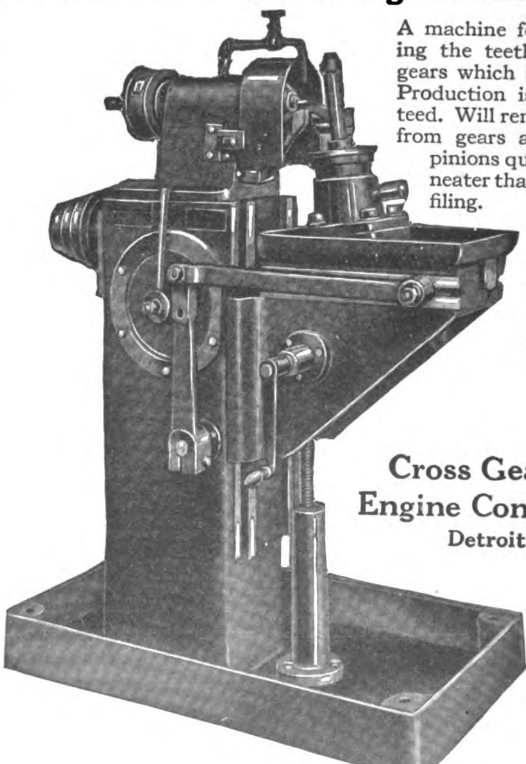
- Tube Heating Furnaces
- Every Type of Gas Blast Burner, Furnace and Heating Machine for Industrial uses.

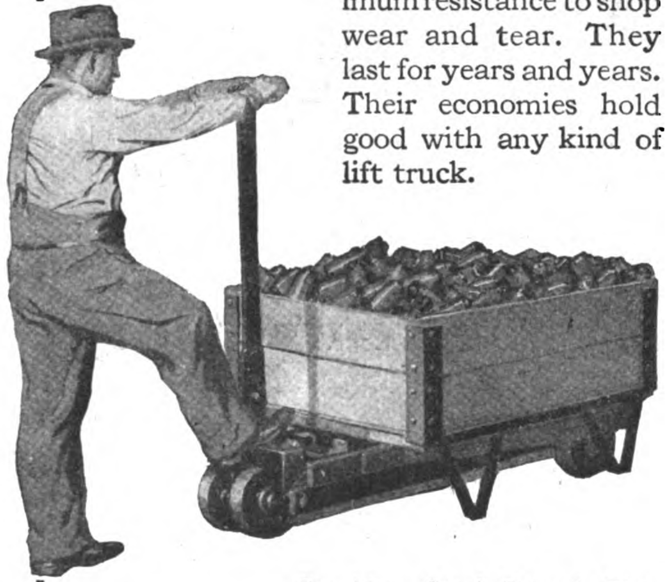




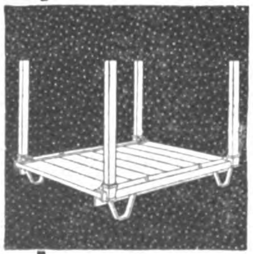


Here's a Load Platform Built to Stand Wear and Tear

Stuebing Steel-Bound Load Platforms will help you trim interior truckingcosts. Through a patented method of assembly they combine lightweight with a maximum resistance to shop wear and tear. They last for years and years. Their economies hold good with any kind of lift truck.



Powerful steel bolts securely clamp siderails, top and legs into one basic unit—a Stuebing feature that assures uniform strength and durability. Bolts bear on steel, won't work loose



Can be had in any width, length and height. Easily altered to serve as box type platform, stake, section bin rack or other types to suit any product

Stuebing Steel-Bound Platforms are rigidly braced with steel angle sidebars the entire length. Wood top keeps bulky loads and smoothly finished parts from sliding off; protects paper and other flat stock against damage. Legs are of forged steel and are broad faced—will not injure floors, ample spacing between legs to clear incline crowns and elevator crossings.

Stuebing Steel-Bound Platforms fit in with every kind of factory hauling. They will carry loads up to ten tons. Because of the big savings they show in repairs and replacements they are by far the cheapest load platform you can use. Write today for descriptive booklet.

The Stuebing Truck Co.
Cincinnati, Ohio

StueBing
LIFT TRUCK SYSTEMS

The Principle Back of the "Clark"

The "Clark" is the *only* Flexible Coupling built on the transmission chain principle.

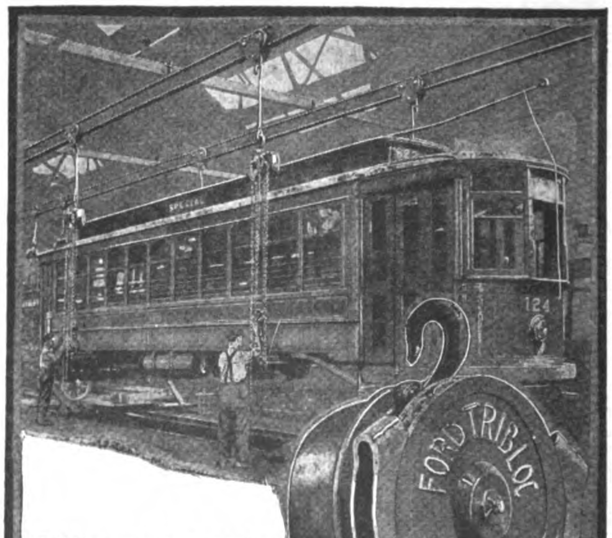
Ideal for reversing drives, because there is absolutely no back-lash or lost motion.

Clark Flexible Couplings are built on *sound* mechanical principles—two sprockets and a roller chain. What could be more simple and at the same time be efficient?

We send any Clark Flexible Coupling for thirty days' free trial—that's how confident we are that the Clark will meet any coupling problem.

An interesting Booklet, *"Flexible Couplings,"* mailed for the asking.

I. H. Dexter Co., Inc.
181 Greenwich Avenue, Goshen, N. Y.



Triblocs are used singly or in batteries. Patented Loop Guide enables operation from any angle. Malleable iron and steel construction prevents breakdown.

Individual capacities to 40 tons

FORD CHAIN BLOCK CO.
2nd and Diamond Sts.,
Philadelphia

Overseas Representative:
Allied Machinery Company of America

FORD TRIBLOC

2214-D

You can put your load-moving and lifting on a surprisingly low cost basis

AN electric hoist for you—power lifting with its consequent economy in time and labor.

"Just the method we have long needed. We are moving and lifting our loads for less than we ever anticipated"—that's the consensus of opinion of the hundreds now using *LiftAbouts*.

A *LiftAbout* is low in first cost—made possible by standardized manufacture and quantity production. Its maintenance is negligible. Easily and quickly installed.

Incorporated in the *LiftAbout* are the same features that have made "Shepards" so well known and so widely used.

$\frac{1}{2}$ and 1 ton capacities for alternating or direct current.

Your first step toward low cost load-moving and lifting will be a request for our bulletin. DO IT TODAY.

"Shepard" also builds electric cranes and hoists in capacities to 30 tons.

SHEPARD ELECTRIC CRANE & HOIST CO.

352 Schuyler Ave., Montour Falls, N. Y.
Branches in Principal Cities
Member Electric Hoist Mfrs.' Assn.

2293-S

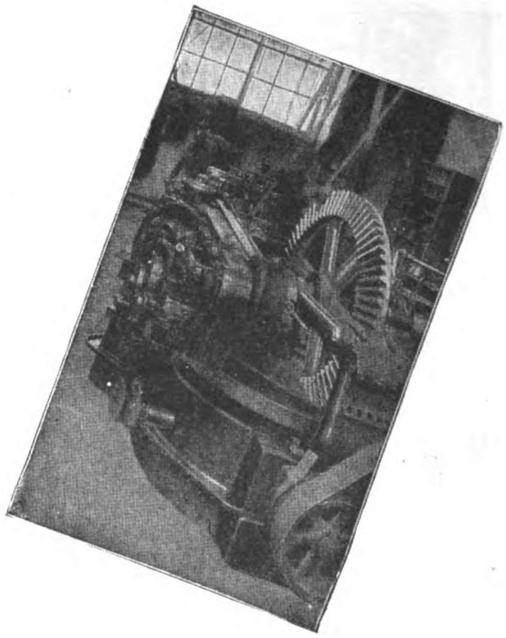
REG. U.S. PAT.OFF.

SHEPARD
ELECTRIC CRANES & HOISTS

Broader Facilities for Better Service

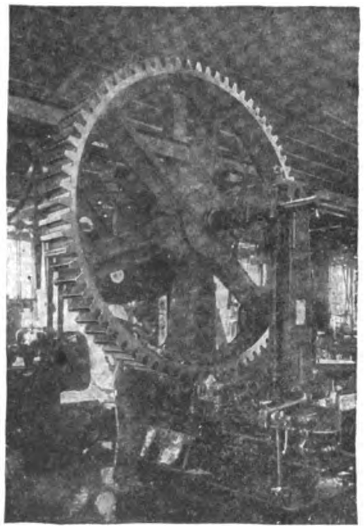
Our present facilities—we have a brand new plant—place us in position to offer gear users a *service* that will put many good dollars in their pockets when the breakdown comes.

We were compelled to broaden in order to hold our service record in an ever-increasing territory. We do not say that it will be humanly possible for us to clip many more minutes from gear producing time, but our two large plants will permit us to benefit a larger number of gear users.



We have claimed a 24-hour service on certain types and sizes of gears and have always made our claims good. We offer a money-saving service on every gear order and are prepared to demonstrate to your satisfaction.

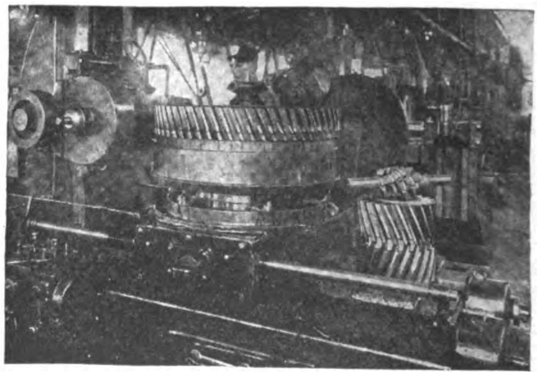
Remember this when next you need gears in a hurry.



Hurry Orders and Breakdown Jobs—

Immediate Attention

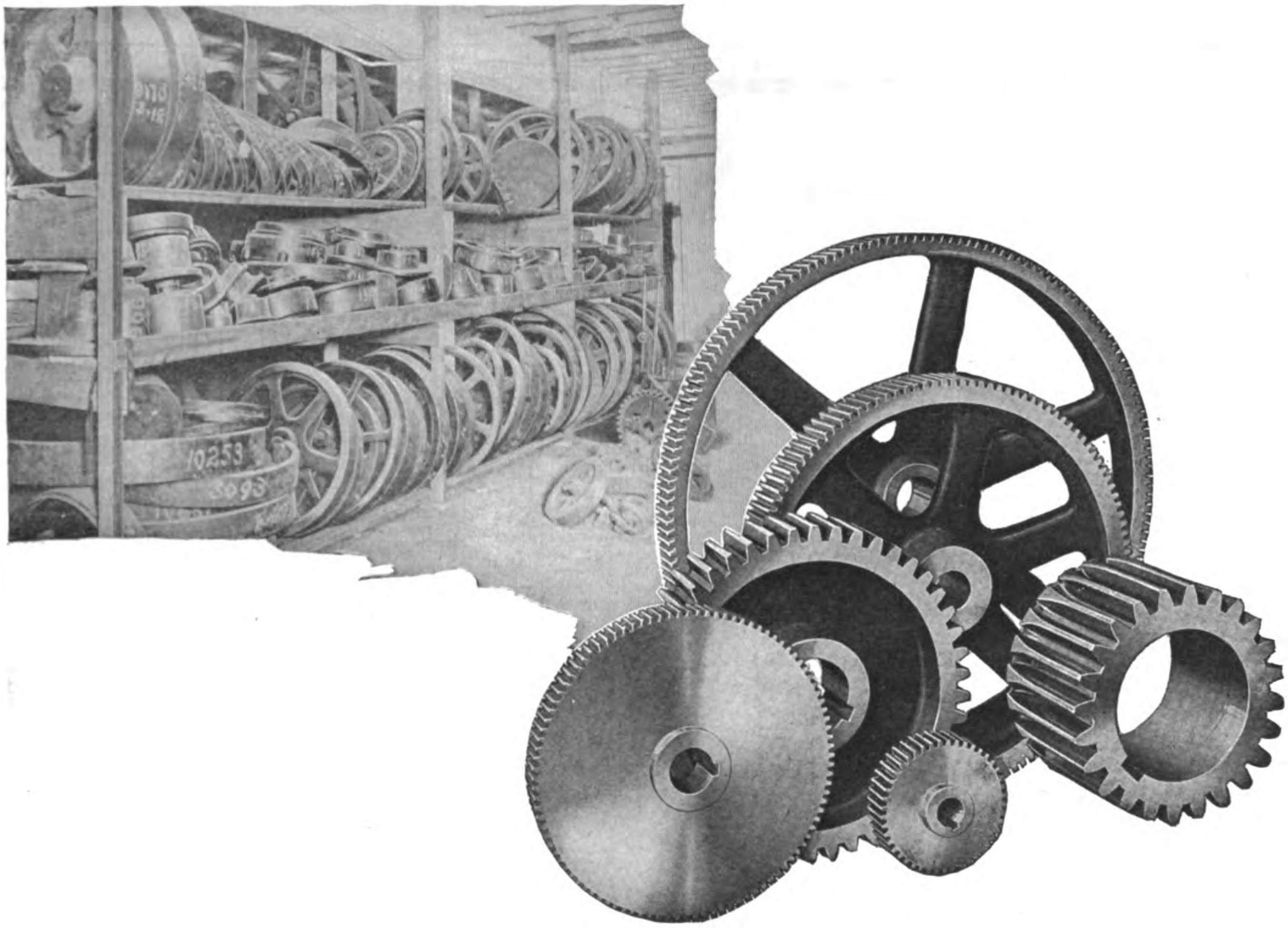
You will value the **Phillie Gear Book.** It prevents error in gear ordering. A copy comes gratis.



Spur — Bevel — Mitre — Spiral — Worm — Helical

Philadelphia GEAR Works, Phila. Pa.

Sprockets — Racks — Rawhide — Micarta — Gears



16,000 Patterns—
A Meachem Short Cut to Quick Gear Service

THE well-stocked Meachem pattern racks are one of the Meachem helps to speedy gear deliveries and low gear costs. A thorough familiarity with the requirements of quality gear-making, the skill borne of 34 years of experience, and the Meachem policy of concentrating on industrial gears are other reasons for the *permanent* satisfaction assured by Meachem Gear Service.

We also make gears and pinions of Formica

THE MEACHEM GEAR CORPORATION

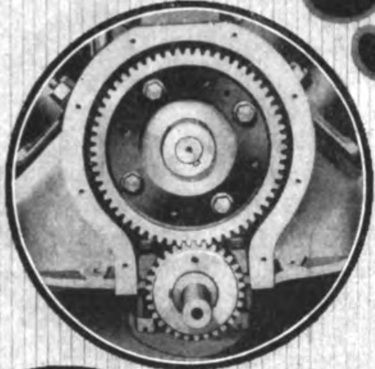
Sole manufacturers of *new process* RAWHIDE GEARS and PINIONS—Still made under the direction of the inventor and the men responsible for every stage in their development.

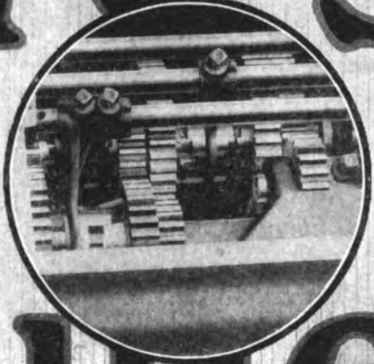
Canal St. and West Shore Railroad, Syracuse, N. Y.

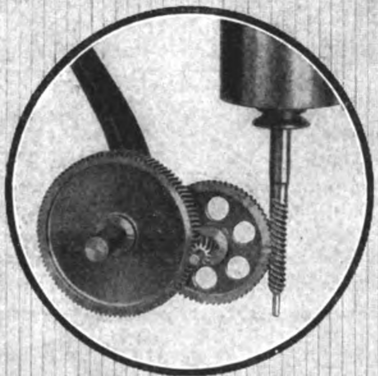
105

MEACHEM
INDUSTRIAL GEARS ONLY

"Zones of Quiet" Gears







Perhaps your product would be improved by the use of "Zones of Quiet" Gears. Their noticeable smoothness in operation and absence of harsh, grinding gear noises always attract favorable attention and mention of the finished article on which they are used. We make—

Spur, Helical, Bevel, Mitre, Spiral, and Worm Gears and Worm Wheels in all metals—also in Bakelite

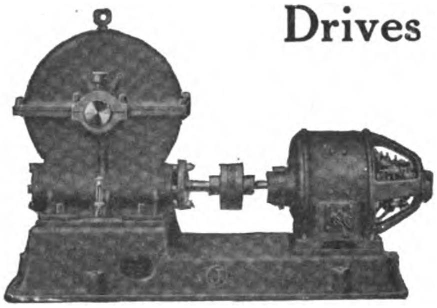
Capacity—10,000 Finished Gears Daily

If interested, send blue print or sample Gear for estimate

AD ALBAUGH-DOVER CO.
2100 Marshall Blvd., Chicago

AGMA
MEMBER AMERICAN GEAR MANUFACTURERS ASSOCIATION

Jones
Enclosed Worm Gear Drives



Furnished in various ratios with or without motor and cast iron base.

W. A. Jones Foundry & Machine Company
Main Office and Factories
4404 West Roosevelt Road, Chicago

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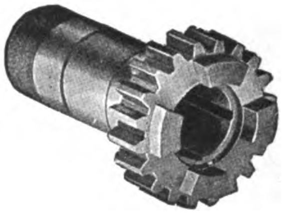
Cast-iron Pulleys, Friction Clutches, Shaft Hangers, Boxes, Couplings, Cut Gears, Cast Gears, Sprocket Wheels, Rope Sheaves, Flywheels, Enclosed Worm Gear Drives, Spur Gear Speed Reducers.

MEISEL GEARS



Part of Meisel Gear Service is to see that you get the right gear for the work you have to do. Our gear experts and our experience is yours to draw upon. If you want highest quality, and correct design, let us take up your gear problems with you.

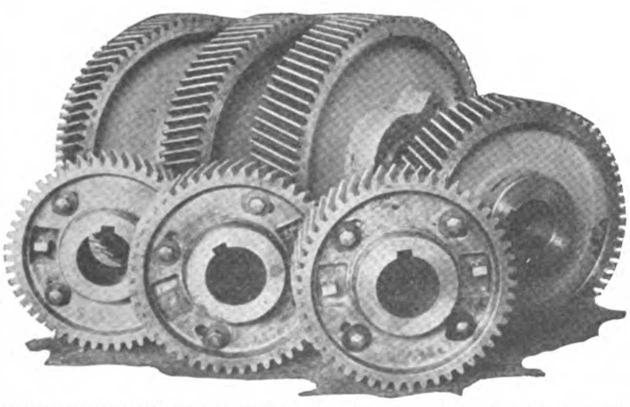
Write today!

Meisel Press Mfg. Co.
946 Dorchester Avenue, Boston, Mass.

Earle Gears

Are made on the basis of "Quality First," which accounts for our long list of satisfied customers. Let us assist you on working out your gear problems.

The Earle Gear & Machine Co.
4707-15 Stenton Ave., Philadelphia



Put Your Machines on the Quality Map

You can do that as far as your small and medium size gears are concerned by equipping your product with *MASSACHUSETTS Gears*.

They are made of the best materials, and cut to the closest tolerances that experience, skill and the most modern equipment can produce.

And what is more you get them as fast as you want them without sacrifice of quality.

The real test—a Trial Order—Send one today

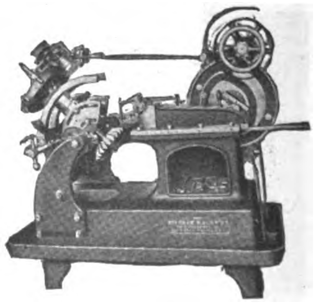
Massachusetts Gear & Tool Co.
Woburn, Mass.

Adding Value to your Product

Bilgram Bevel Gear Generators cut theoretically correct gears. Such gears are especially adapted to machines of the better grade.

We have special facilities for cutting Spur, Worm, Helical, Miter, Internal and Elliptical Gear Wheels.

Let us quote on the gears you use



The Bilgram Machine Works
1233 Spring Garden Street, Philadelphia, Pa.

BOSTON Cut Gears

Years of close application to the requirements of particular Gear users have raised Boston Gears to an enviable position. From expert metallurgists to hair line inspectors they pass through the hand of experts who know nothing but good gears.

Get our Catalog and note the Service we can render.

The Boston Method Saves You Money

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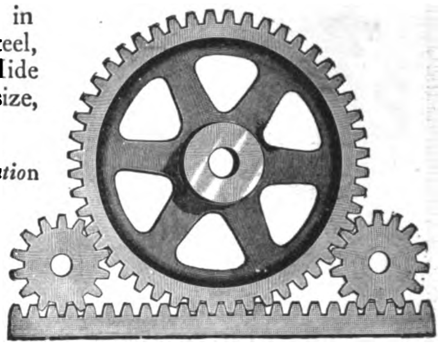
GRANT GEARS

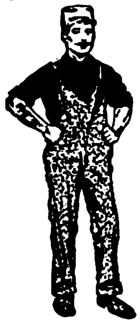
accurately cut in Cast Iron, Steel, Brass, Raw Hide and Fibre; any size, any quantity.

Catalog on application



Grant Gear Works, Inc.
151 Pearl St., Boston, Mass.

H. B. UNDERWOOD CORP.

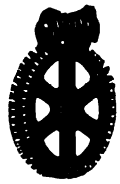


Est. 1870
Engines Repaired Everywhere

The men in our Engine Repair Department have seen every manner and type of breakdown.
The methods and tools they have employed to repair them are available for your use.
Note well the name "Underwood"—have it in mind the next time you have an emergency job.

"Helpful Hints" free for the asking.

PHILADELPHIA, PA.



ALBRO-CLEM HINDLEY GEARING
WILL DO THE WORK
When Common Worm Gearing Fails
ALBRO-CLEM ELEVATOR CO.
503 Erie Ave., East, Philadelphia, Pa.

HERRINGBONE CUT GEARS

MILL DRIVES
SPEED REDUCERS
SPUR
WORM
BEVEL GEARS
FAWCUS MACHINE CO. PITTSBURGH, PA.

GEARS for MOTOR MACHINE MILL or POWER PLANT

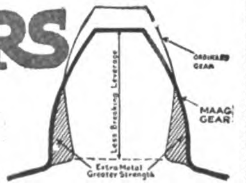
ENGINEERS — ESTABLISHED 1864 — FOUNDERS
THE A. & F. BROWN CO.
79 BARCLAY ST. NEW YORK
MACHINISTS — MILLWRIGHTS

Planed Bevel Gears up to 48" diam.
Cut Spur Gears up to 96" diam.
Machine Moulded Gears up to 192" diam.

Steel, Semi Steel, Cast Iron, Bronze, Bakelite, Condensite, Fibre, etc.

"TRY SIMONDS GEARS"
They are accurately cut.
All kinds and all materials.
THE SIMONDS MANFG. CO.
PITTSBURGH, PA.

MAAG GEARS



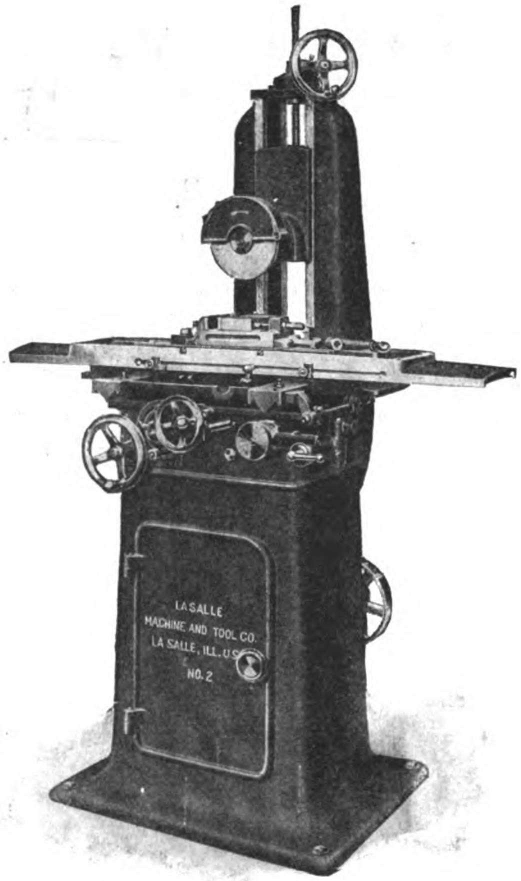
Strongest at the Base
Where Others are Weakest
Catalogue No. 265
Niles-Bement-Pond Co.
111 Broadway, New York

CONNECTICUT GEARS

5 P or finer spur or worm gears 36 in. or smaller
10 P or finer helical, spiral, herringbone 8 in. or smaller
May we quote you?
545 Cooke St., WATERBURY, Conn.

Cut Gears
Peerless Rawhide Pinions
The Horsburgh & Scott Co.
Cleveland, Ohio

Don't Waste Oil
On Countershafts and Loose Pulleys. Eliminate them by using Mule-Pull Clutches. *Send for circular.*
Brown Engineering Co.
115 N. Third St., Reading, Pa.



La Salle No. 2
Automatic Surface Grinding Machine

The surface Grinding Machine for all types of tool room, machine shop and manufacturing work.

It combines great rigidity, long life and perfect alignment—all important requirements in Grinding Machines. Working parts and feed mechanisms are protected from dirt or chips.

The table travels automatically in both directions, the stroke regulated by dogs; the reversing lever may be turned clear to allow the table to run past without changing the stroke. A hand power table movement which does not interfere with the automatic feed, is available.

The work table is 49 inches long, 8 inches wide, has a working surface of 20 inches long, 6 inches wide, 10 inches high and with three slots ½ inch wide; has a cross feed movement with automatic feed workable in either direction and automatic stop when the cut has been made.

Machine illustrated is belt driven, can be furnished for motor drive, wet grinding attachment and on special order a 4 inch index center for grinding taps, hobs and other milling cutters. Magnetic chuck on special order. Net weight with countershaft 1800 lbs.

Illustrated circulars and price lists on request.

La Salle Tool Co.
La Salle, Illinois, U. S. A.

BLOUNT Specifications are significant

When ordering a MOTOR GRINDER, always specify Enclosed Guards. This is Safety Protection for you and your workman.

BLOUNT MOTOR GRINDERS come equipped with enclosed guards at no extra cost.

BLOUNT Ball Bearing Motor Grinders

Built in 7 Sizes

½ HP. with 8 x1 in. wheels.
¾ HP. with 10 x 1 in. wheels.
1 HP. with 10 x 1½ in. wheels.
2 HP. with 12 x 1½ in. wheels.
3 HP. with 14 x 1½ in. wheels.
3 HP., HD. with 14 x 2 or 12 x 2 in. wheels.
5 HP., HD. with 18 x 3 or 16 x 3 in. wheels.

J. G. BLOUNT CO.
Everett, Mass.

Circulars sent on request

Ransom No. 190

This grinding machine runs only when the operator's foot is on one of the pedals.

Oil switch ball-bearings, ¾ hp. General Electric motor A.C., enclosed type guards, capacity, two 12 in. x 1 in. wheels.

Ransom Mfg. Co.
Oshkosh, Wis., U. S. A.

Big shear blades are ground with ease and dispatch

on the

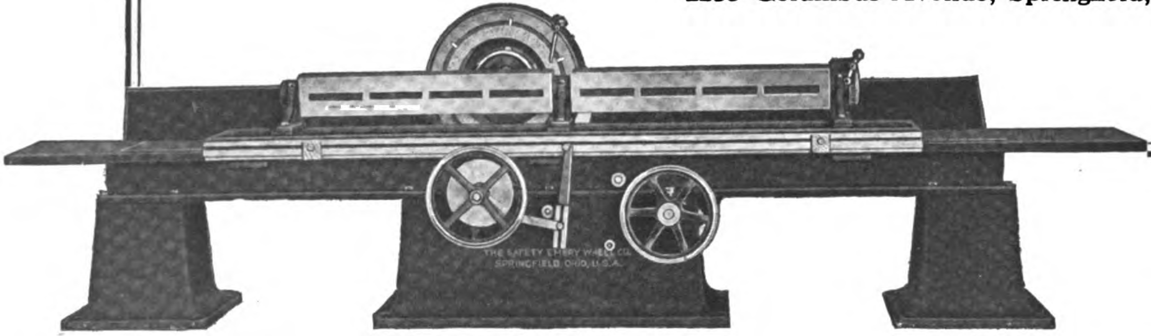
SAFETY Knife Grinder

For Steel Mill use this member of the "SAFETY" Family is a paying investment. It is also the ideal machine for the manufacturer of heavy trimming knives for printers and paper manufacturers and shear blades for all purposes.

The machine has adjustable knife bars and is easy to operate. It has the usual "SAFETY" features that practically nullify accident hazard.

If you do any grinding at all, you will find a lot of valuable data about Grinding Wheels and Machinery in our Catalog. Write for a copy today.

The Safety Emery Wheel Co.
2258 Columbus Avenue, Springfield, Ohio



SAFETY TRADE MARK

On Wheels

It is the grinding wheels that keep things up to pitch in your plant. Your tools, the hands of your machines, need constant grinding to keep them on the job.

You cannot afford to be haphazard in your choice of wheels. Only the very best will be cheapest in the end.

For 50 years VITRIFIED WHEELS have stood the test. Fluxed at enormous temperatures they cut quickest and hardest without glazing or gumming.

Write us giving your specifications and we will advise you.

VITRIFIED
Wheel Co., Westfield, Mass.

Thousands Of Years Ago!

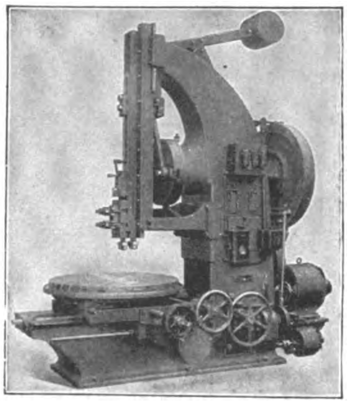
Thousands of years ago, during the process of formation of the Earth's crust, nature manufactured the substances which have now become indispensable to industry as abrasives.

Modern requirements, however, demand more than just the raw materials, and after years of careful study and experiment, STERLING GRINDING WHEELS have been evolved, combining cool running with speed and great cutting power.

Made in various shapes and all sizes with a grade and grain to meet your needs.

Every grinding executive should have our catalog.

The Sterling Grinding Wheel Company **Tiffin, Ohio**



William Sellers & Co. Incorp.

Philadelphia, Pa.

Sellers Slotters

Bar driven by variable crank with quick return. Length of stroke and bearing for bar adjustable to suit height of work. Automatic rotary, cross and longitudinal feeds, also easy hand adjustment. Operating rods and controlling apparatus grouped for convenient manipulation. Design, construction and arrangement insure

Accuracy—Maximum Output—Durability

SHAFTING—LABOR-SAVING MACHINE TOOLS—INJECTORS

Safety First?

Yes, certainly, safety first, last and all the time. But that does not mean you must overlook the cardinal virtues of efficiency and economy of operation. Our Model 56 grinder combines these with the highest possible degree of safety.

Forbes & Myers
170 Union St., Worcester, Mass.

BRYANT CHUCKING GRINDER COMPANY

SPRINGFIELD, VERMONT

Reg. U. S. Pat. Off.

Builders of

Hole Grinders

Hole and Face Grinders

Deep Hole Grinders

GRAND RAPIDS DRILL—TAP—CUTTER GRINDERS

Guarantee
Perfect Grinding—Most Rapid Production
Send for Catalog

Grand Rapids Grinding Machine Company
33 Ottawa Ave. N. W., Grand Rapids, Mich.

BATH
Universal Grinding Machines

for Cylindrical, Surface, Internal, Disc, Tool and Cutter Grinding.

Built by
Universal Grinding Machine Co.
FITCHBURG, MASS., U. S. A.

Grind Your Shop Costs with a

Marschke Economy Grinder

Built to give unfailing service at minimum cost. Write for the full details. You'll be interested.

Marschke Mfg. Co.
Indianapolis, Ind.

BADGER GRINDERS

The recently designed Badger Grinder, incorporating many practical ideas which are the result of years of experience, places the disc grinder on the list of necessary machine tools.

Disc Grinder information gladly furnished.

Badger Tool Co., Beloit, Wis., U. S. A.

E. B. Gardner, Pres. "Disc Grinder Service": R. D. Gardner, Treas.

When You Think of a Disc Grinder, Think of a

GARDNER

Gardner Machine Co., Beloit, Wis., U. S. A.

Knee Type Ring Wheel GRINDER For Flat Surfaces

The* GRAHAM MFG. CO., *Providence, R.I.

Grinding Machinery **Polishing Machinery**

DIAMOND MACHINE CO., PROVIDENCE, R.I.

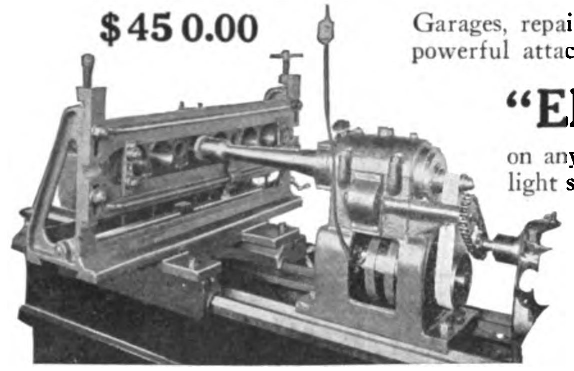
FITCHBURG
Cylindrical Grinding Machine

Various sizes, both Power Feed and Hand Operated, for work up to 54 inches in length.

FITCHBURG GRINDING MACHINE CO.
Fitchburg, Mass., U. S. A.

Make any Lathe a Cylinder Grinder!

$450.00



Garages, repair and machine shops find that a small investment in this sturdy, powerful attachment opens the door to a lucrative regrinding trade. Put the

"ELTECO" CYLINDER GRINDER

on any lathe, old or new, of 14-in. swing or larger, attach to an electric light socket and you're ready to handle the biggest 6-cylinder block that's made. Its precision is another feature.

You don't need to be told of the big money that's waiting for progressive shops in the regrinding field. Write TODAY for our terms and full description!

LIBERTY TOOL COMPANY, Irvington, N. J.

Get Practical Diamond Information

Industrial and scientific diamonds and diamond pointed tools are valuable equipment. Inexperience in using them will result in serious loss unless the user is guided by practical diamond information.

Such information is available to the diamond user through this company.

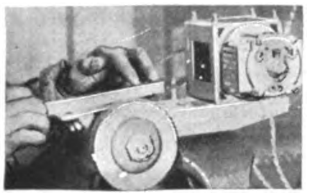
Write for full information and our instructive catalogue "Diamonds and Diamond Pointed Tools." Writing entails no obligation on your part.

WHEEL TRUEING TOOL CO.

Importers of
Borts & Carbon Diamonds
Manufacturers of
Diamond Tools for Every Mechanical Purpose
2129 PENOBSCOT BUILDING, DETROIT

Eastern Office: 527 Fifth Ave., New York City. Cleveland Office: 343 Engineers Bldg. Western Office: 1105 Great Northern Bldg., 20 Jackson Blvd. W., Chicago, Ill. Canadian Branches: Windsor, Ont., St. Catharines, Ont. Cable Address: "Wheeltruco," Detroit.

Precision Grinders Speed Production
Write for Catalog.
Wilmarth & Morman Company
Master Grinder Makers.
1187 Monroe Avenue, N. W.
Grand Rapids, Michigan.
Drill Grinders—Universal Grinders
Surface Grinders



RIGID—LIGHT
PORTABLE GRINDER

Internal and external grinding. Does wide range of grinding work. Ball bearings. High speed. One H.P. motor, any current. Weight, 22 lbs. For use on any machine tool. Investigate.

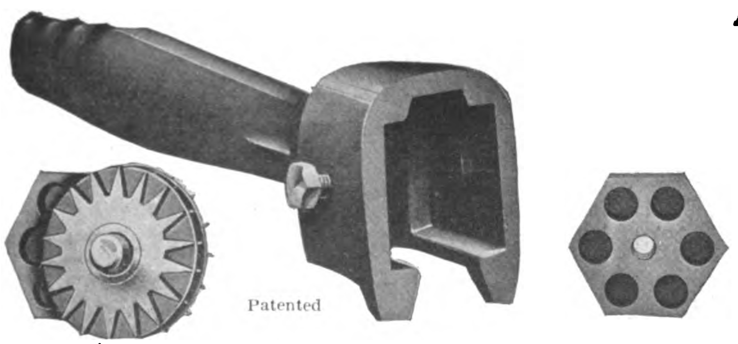
ARVA STROUD RV
327 Broadway, New York City

GISHOLT

LABOR SAVING EQUIPMENT

TURRET LATHES
Hand Operated
For Chucking and Bar Work
AUTOMATIC TURRET LATHES
For Chucking Work
VERTICAL BORING and TURNING MILLS
UNIVERSAL TOOL GRINDERS
HORIZONTAL BORING AND DRILLING MACHINES
CYLINDER GRINDERS
TOOL-POST TOOL HOLDERS
REAMERS, "SOLID ADJUSTABLE"
Shell and Chucking
BORING BARS
With Adjustable Cutters
PERIODOGRAPH
For Time Recording in Factories
Separate Catalogs on each Product
Send for the ones you want

GISHOLT MACHINE CO.
1201 E. Washington Avenue
Madison, Wisconsin, U. S. A.



Made in two sizes:
No. 1 cutters 1½ in. diameter
No. 2 cutters 2⅜ in. diameter

Bearing worn out?
Turn on a new one.

Don't scrap the dresser when one bearing for the cutter is worn. The

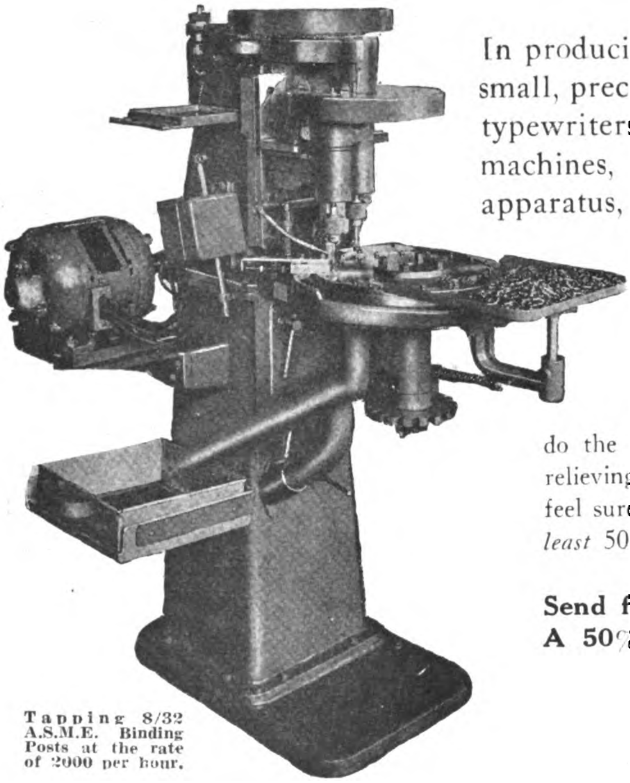
DESMOND HEX

has six sets of bearings. A new one is available at a turn of the nut.

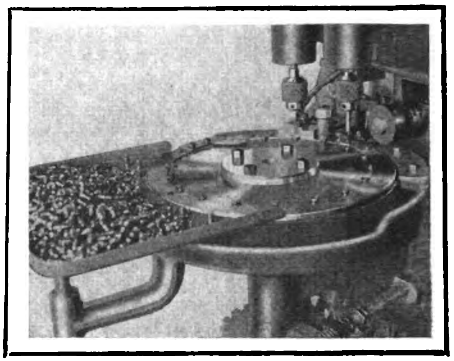
Desmond-Stephan Mfg. Co.
Urbana, Ohio

REPRESENTATIVES:
Canadian: Desmond-Stephan Mfg. Co., Ltd., Hamilton, Ontario
Alfred Herbert, Ltd., Coventry, England, Paris, Milan, Yokohama

Think what this means to your production program:



Tapping 8/32 A.S.M.E. Binding Posts at the rate of 2000 per hour.



In producing all those small, precise parts for typewriters, adding machines, electrical apparatus, etc., let the

ANDERSON
Dial-Feed Multiple Spindle Tapping Machine

do the tapping, burring and counter-sinking operations; thus relieving your screw machines of these allied operations. We feel sure that in this manner *you will increase your output at least 50%.*

Send for full description of the "Anderson" today. A 50% production increase is worth looking into.

Anderson Die Machine Co.
Bridgeport, Conn.

TRAVEL

Another Development

Yet another startling development in the **Silver 20-in. Upright Drill.**
The new model is 6¾ in. higher than the old style. This has enabled us to increase the spindle travel from 10 in. to 12 in. Think what a difference this improvement will make in the range of your work!
The base as well as the table is planed true square with the spindle making the Silver the ideal tool for boring cylinder blocks, etc.
There are many other good points you cannot afford to miss.
Write for Catalog.

The Silver Mfg. Co.
Box 360, Salem, O.
Established 1854

Enjoy the advantages of an All-Geared Drill

The positive drive of the All-Geared Self-Oiling Drill insures higher production.

Since the operator has no belts or oiling duties to bother with, this high rate of production is maintained.

Ask for Catalog A

BARNES DRILL CO.
Inc. 1907
830 Chestnut St., Rockford, Ill., U. S. A.

AGENTS FOR GREAT BRITAIN: Burton, Griffiths & Co., Ltd., London, E. C. FRANCE: R. S. Stokvis & Fils, Paris. JAPAN: Boku Itoku Shoten, Tokyo. ITALY: Alfred Herbert, Ltd., Milan. NEW SOUTH WALES: R. L. Scrutton & Co., Sydney. BELGIUM: G. & F. Limbourg, Freres, Brussels. SPAIN and PORTUGAL: American Machinery Corporation, S. A. E., Madrid. Sindicato de Maquinaria Americana, Bilbao.

Do Your Uniform Accurate Tapping on the "Tuttle"

This machine meets the need for great accuracy and uniformity of tapping up to ¼ inch in diameter. It will tap holes square with the work and can be set to tap any depth and automatically release thus preventing the breaking of taps. The ease and rapidity of manipulation results in larger output of uniform work.

Tap It On The "Tuttle"

Made in two styles for hand lever and foot lever operation.
Send for Illustrated Circular giving all details.

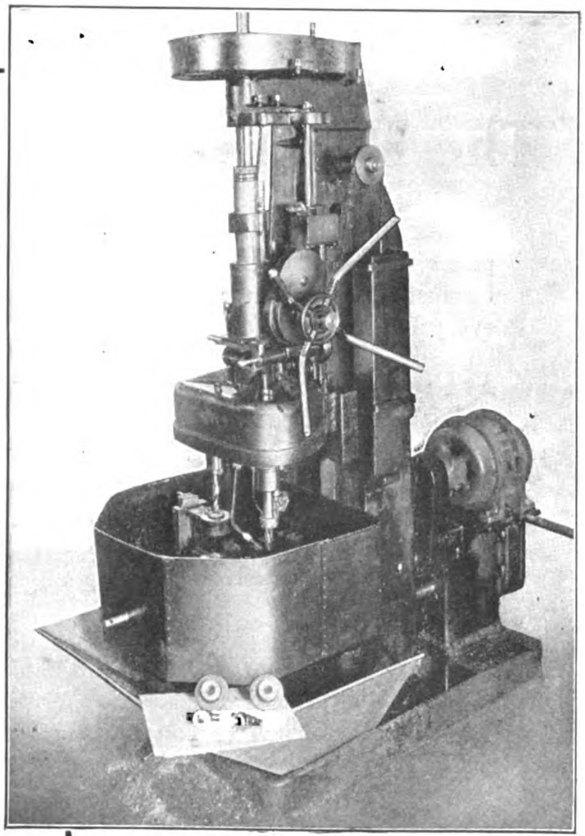
Evans Stamping & Plating Company
Taunton, Mass.

THE ROCKFORD DRILLING MACHINE Co. ROCKFORD ILL. U.S.A.

Up-to-the-minute production of automobile and similar parts

Watch for the diamond shaped name plate with "Rockford" on it and you will see how we have helped others solve many difficult machining problems. Put your problems up to our Engineering Department. They will be handled promptly and you will receive a careful analysis of your particular problems and a frank statement as to our ability to solve them.

Rockford Drilling Machine Co.
Rockford, Ill.



ROCKFORD
20 in. Drilling Machine with Rotary Table

The time is near at hand when more speed in your drilling will count big

The disagreements in the coal and railway fields are settled and the return of business to normal will not longer be delayed.

What this means is that every shop will have to produce a little faster to make up the lost ground.

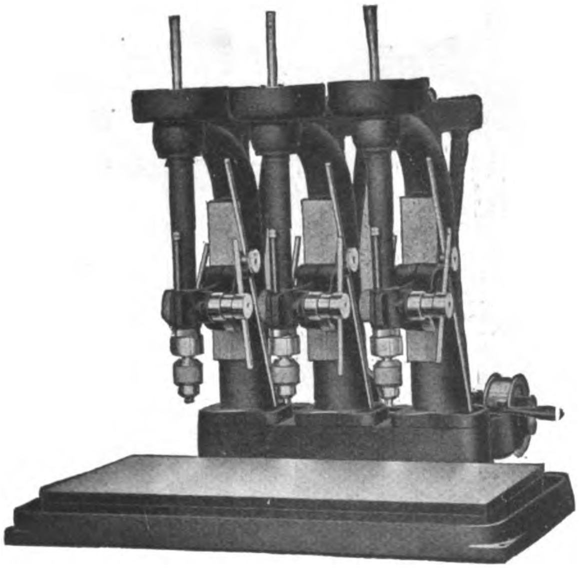
Are you prepared for this increased production—especially in your drilling department?

It is there where speed means more holes per minute, which in turn means faster production and more profits for you.

But speed is not all that determines the best drilling machine. Combined with the speed must be accuracy, long life, ability to maintain speed for long periods without trouble.

Such a combination is found in Leland-Gifford Sensitive Drilling Machines, that are built to maintain speeds of from 3,000 to 10,000 r.p.m. without flinching.

Let us send you the complete facts.



LELAND-GIFFORD-COMPANY WORCESTER MASS U.S.A. MACHINE TOOLS-CRANK SHAFTS

Leland-Gifford Co.
Worcester, Mass., U. S. A.

The Minute-Savers

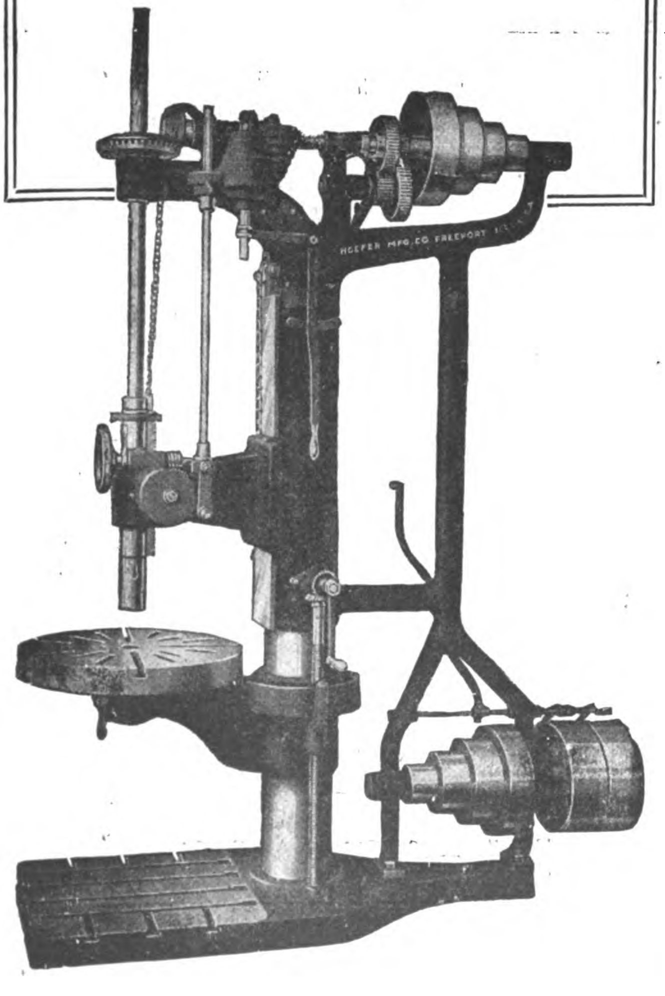
Hoefer Drillers — at their former prices were a profitable investment because of the minutes they saved on every drilling job.

At their "back-to-normal" prices —Hoefer Drillers, add to their minute-saving profits, a worth-while saving in initial cost.

Are you in a position to overlook such an opportunity to effect a saving in your drilling work?

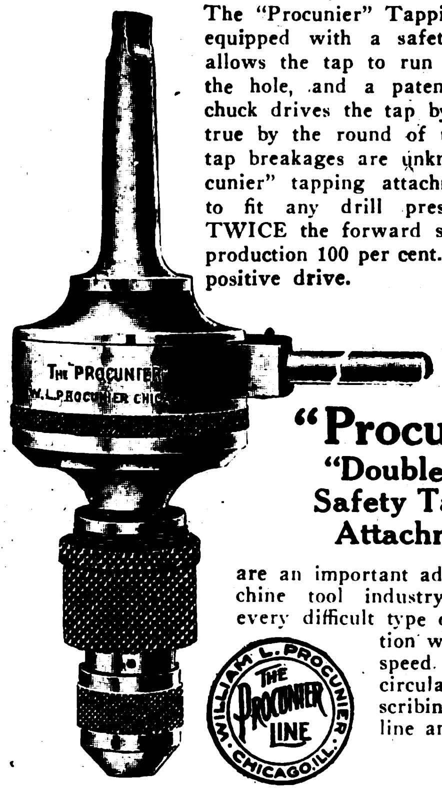
Certainly you will want full details of the minute-saving features. A line will bring them to you quickly.

HOEFER MFG. CO.
FREEPORT, ILL.



No More Broken Taps

The "Procunier" Tapping Attachment is equipped with a safety friction which allows the tap to run to the bottom of the hole, and a patented "double-jaw" chuck drives the tap by the square and true by the round of the shank. Thus tap breakages are unknown. The "Procunier" tapping attachment is designed to fit any drill press. Reversing at TWICE the forward speed, it increases production 100 per cent. Also made with positive drive.



"Procunier"
"Double Jaw" Safety Tapping Attachments

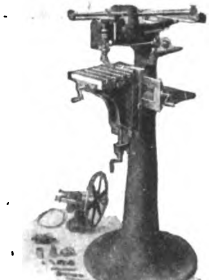
are an important advance in the machine tool industry. They handle every difficult type of tapping operation with both ease and speed. Send for copy of circular completely describing the "Procunier" line and let us prove it.

WILLIAM L. PROCUNIER CHICAGO, ILL. THE PROCUNIER LINE

William L. Procunier
18 S. Clinton St., Chicago

Rapid—Economical

The Gorton Engraving Machine



A favorite in radio plants, for engraving and graduating bakelite dials, marking panels, etc.

Cheaper engraving work without any sacrifice of quality is made possible by the simplicity and speed of the Gorton machine method.

The direct saving in time, effort and expense in the production of engraving or in the finishing of dies, small parts, etc., makes Gorton Machines indispensable.

Write us today for detailed data on your class of work

GEO. GORTON MACHINE COMPANY
Racine, Wisconsin

Quint
VERTICAL TURRET

The Quint No. 4, 32-in., six spindle Turret Machine, bores, drills and taps. Saves time on series operation jobs. Also built with four spindles.

Ask for details.

Turner Machine Company, Danbury, Conn.

FOSDICK
TRADE MARK REG. U. S. PAT. OFF.

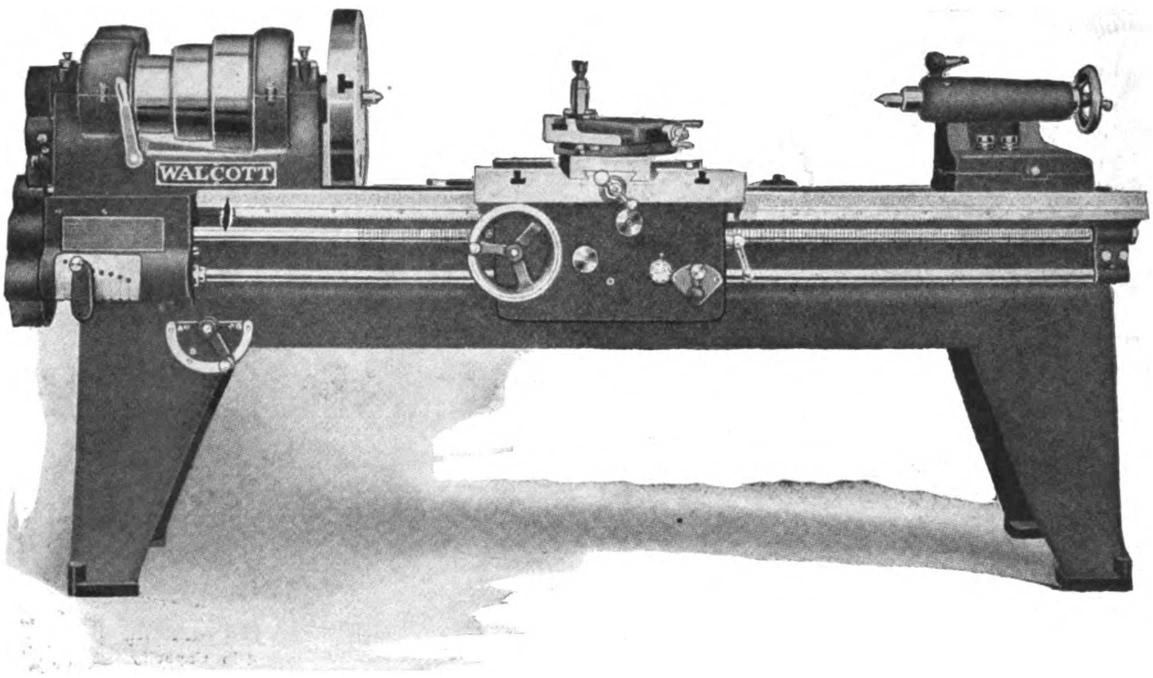
High Speed Ball Bearing Sensitive Drills and Heavy Duty Radials

Advanced design and high grade construction make them the logical tools to use for efficient, low cost production. Investigate.

The Fosdick Machine Tool Company
Cincinnati, Ohio, U. S. A.

WALCOTT

A High-Grade Lathe at a Low Price



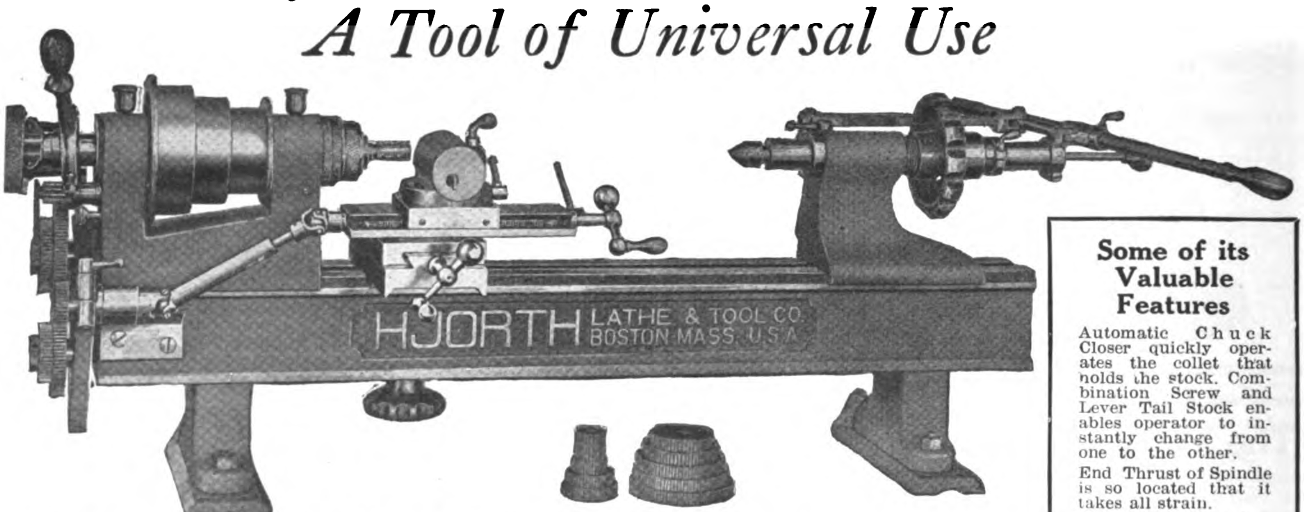
A Wide Range of Sizes

14 in.
16 in.
18 in.
20 in.
26 in.
29 in.

WALCOTT LATHE COMPANY
Jackson, Mich.

The Hjorth Precision Bench Lathe

A Tool of Universal Use



Some of its Valuable Features

Automatic Chuck Closer quickly operates the collet that holds the stock. Combination Screw and Lever Tail Stock enables operator to instantly change from one to the other.

End Thrust of Spindle is so located that it takes all strain.

Patented T Rest has binder down low out of the way of the hand tool.

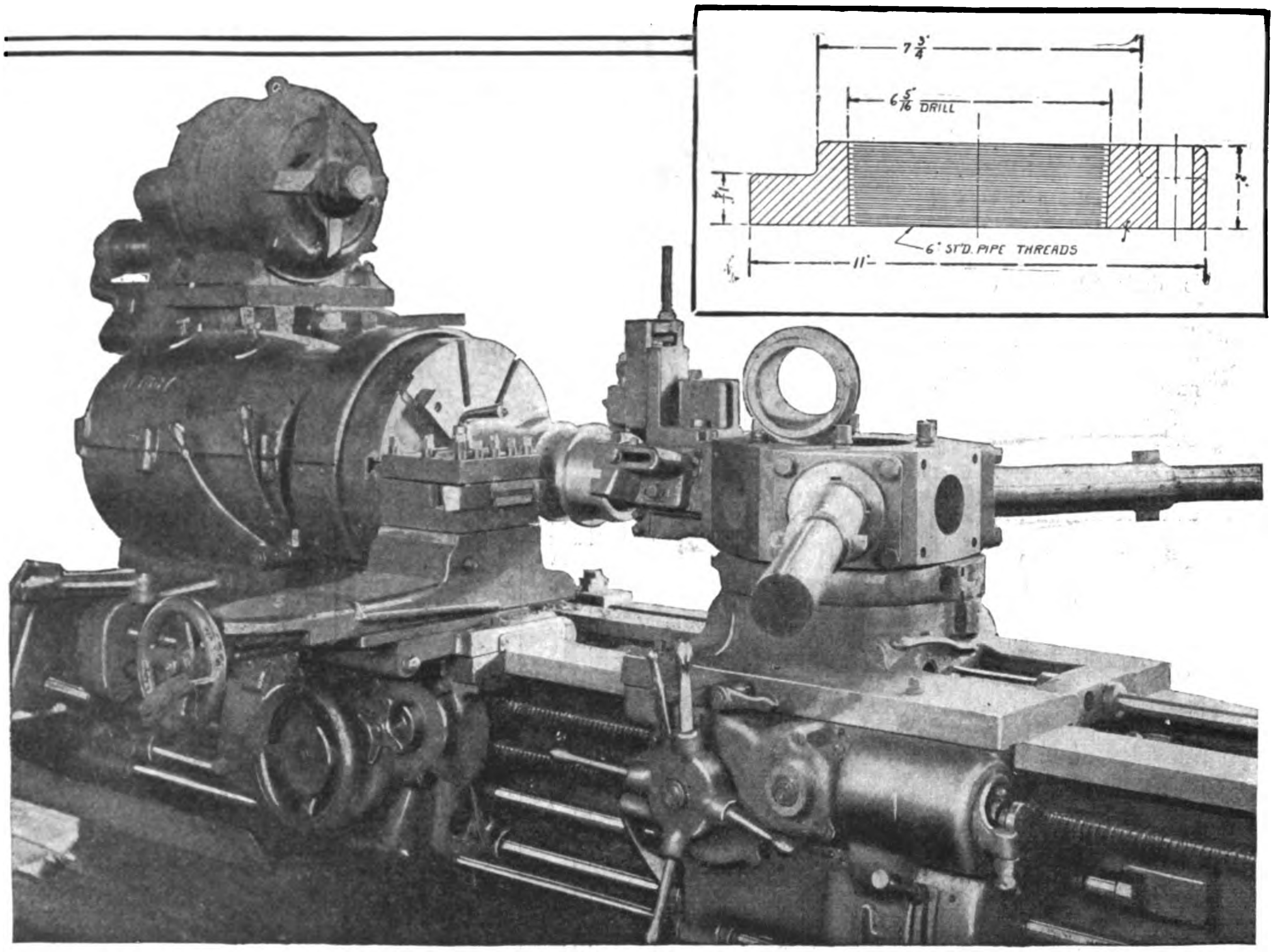
The HJORTH PRECISION BENCH LATHE, finished to master standards, with its full complement of attachments constitutes, in truth, a *Tool of Universal Use.*

In a HJORTH you can perform quickly and precisely many of the small and medium sized jobs that you would ordinarily delegate to large and expensive drilling machines, millers, grinders, and turret lathes.

Encourage your operatives to become proficient in its use.

We will be glad to give you full details

Hjorth Lathe & Tool Co. ***General Offices:*** **27 School St., Boston, Mass.** ***Works:*** **Woburn, Mass.**



Libby Lathe reduces labor costs from 64 cents to 11 cents in the oil field

That Libby Lathes are setting a new standard of efficiency in the oil field as in scores of other fields, is made plain by the story of "Libby" service on the Houston (Texas) plant of the Lucey Mfg. Corp.

Among the oil well supplies produced in quantity by this firm, are what they call Suction Flanges, per sketch on this page.

Prior to installing "Libby" Lathes, the labor alone for machining these parts cost them 64c. each. On the "Libby" Lathe the labor cost is 11c. each, a saving of $21.20 per day on labor.

The investment is more than twice paid for in savings in one year, while the "Libby" is still good for many years' service.

Much to your surprise, you'll find the "Libby" paying big dividends on comparatively small runs in small shops as well as in year-round production of one item.

In the largest automotive, railroad, electric motor plants and scores of other representative industries, this lathe has been a big factor in getting costs down to a "deflation" level.

You'll be interested in the details behind the performance of this glutton for hard work. A "Libby" production estimate will cost you nothing, and will help you check up the efficiency of your present equipment. Write today.

International Machine Tool Co., Indianapolis, Ind.

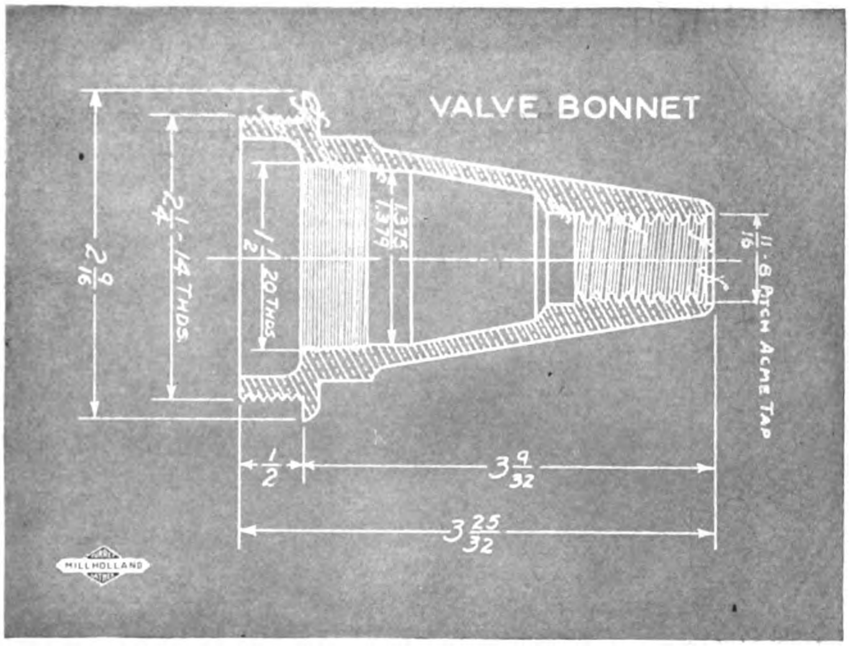
DOMESTIC AGENTS: Aumen Machinery Co., Baltimore, Md.; Blackman-Hill-McKee Machinery Co., St. Louis, Mo.; Brown & Zortman Machinery Co., Pittsburgh, Pa.; Eccles & Smith Co., San Francisco, Calif.; Eccles & Smith Co., Los Angeles, Calif.; Eccles & Smith Co., Portland, Ore.; Eccles & Smith Co., Seattle, Wash.; E. L. Essley Machinery Co., Chicago, Ill.; E. L. Essley Machinery Co., Moline, Ill.; E. L. Essley Machinery Co., Milwaukee, Wis.; Hill, Clarke & Co., Boston, Mass.; Northern Machinery Co., Minneapolis, Minn.; Seifreat-Woodruff Co., Cincinnati, Ohio; Seifreat-Woodruff Co., Dayton, Ohio; Strong, Carlisle & Hammond Co., Detroit, Mich.; Strong, Carlisle & Hammond Co., Cleveland, Ohio; Syracuse Supply Co., Syracuse, N. Y.; Syracuse Supply Co., Buffalo, N. Y.; Syracuse Supply Co., Rochester, N. Y.; Vandyck Churchill Co., New York, N. Y.; Vandyck Churchill Co., New Haven, Conn.; Vandyck Churchill Co., Philadelphia, Pa.

FOREIGN AGENTS: Anderson Meyer & Co., Shanghai, China; Coats Machine Tool Co., London, England; Ing. Ercole Vaghi, Milan, Italy; Isbecque, Todd & Co., Belgium; Isnoskoff & Co., Petrograd, Russia; Isnoskoff & Co., Moscow, Russia; Isnoskoff & Co., Ekaterinburg, Russia; V. Lowener, Copenhagen, Denmark; V. Lowener, Christiania, Norway; V. Lowener, Stockholm, Sweden; Victor G. Mendoza Co., Havana, Cuba; Moerch & Roumet, Paris, France; Mitsui & Co., Ltd., Japan.

MILLHOLLAND

No. 1 of a series, showing actual Millholland Geared Head Turret Lathe jobs.

Turret Lathes—Screw Machines



Time Saved on Valve Bonnets

The bronze valve bonnet illustrated here was done in two operations on a No. 4 Millholland Geared Head Turret Lathe.

Time, 4 minutes complete.

It is an excellent example of the kind of work to which Millholland Geared Head Turret Lathes are best adapted; it combines three operations—boring, facing, threading, and tapping.

Have you a similar job in *your* plant?

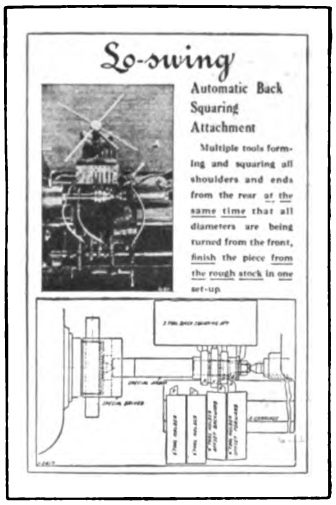
We will gladly prepare a production estimate, and discuss its applicability to Millholland Turret Lathes. Send blueprints or sample with machining instructions.

MILLHOLLAND MACHINE COMPANY

1101 West 23rd Street, Indianapolis, Indiana

Write For This Book It Contains Useful Information For The Production Engineer

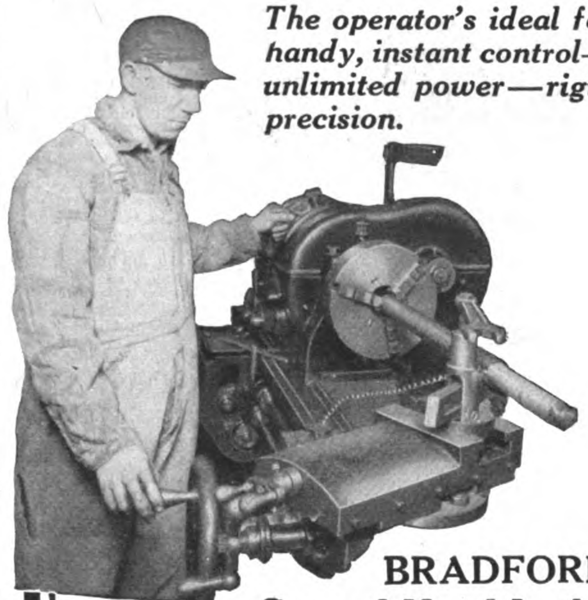
So-swing



So-swing

FITCHBURG MACHINE WORKS
FITCHBURG, MASS.
U. S. A.

The operator's ideal for handy, instant control—unlimited power—rigid precision.



BRADFORD Geared Head Lathe

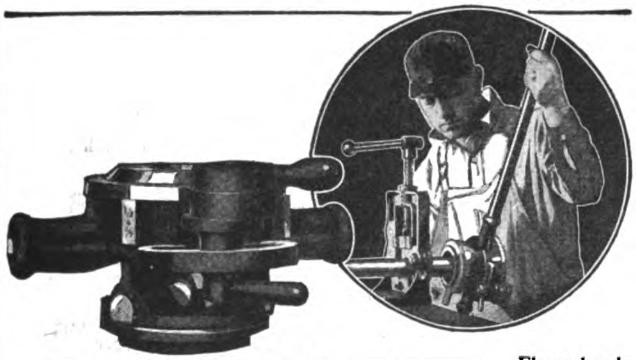
Gears cannot be shifted under load. Feed rod and lead screw cannot be engaged simultaneously. The few speed and feed controlling handles are placed where the operator **instinctively** reaches for them. No electric brake or electric control of any kind is necessary.

Besides the famous Bradford low drive principles with its "down pull" and shock-absorbing gears, eliminates the chatter common to geared-head lathes, and preserves Bradford precision noted for a quarter century against years of heavy cuts and fast feeds.

Get Bulletin No. 25 Today

The Bradford Machine Tool Co.
Cincinnati, Ohio, U. S. A.

"I have just finished an emergency job on which your No. 102 paid for itself. After using the solid dies, the use of a Bull-Dog is as child's play in comparison."
A Chicago User.



OSTER
BULL-DOG DIE-STOCKS

Eleven handy tools, plain and ratchet types, each threading 4 to 8 pipe-sizes. For example, No. 102 threads ¼, ⅜, ½, ¾, 1 and 1¼ inch pipe.

"the tool with the five big features" and the biggest is this—*the dies open up.* In other words, there is no laborious backing-off at the end of each cut which serves only to waste time and injure the clean edges of the freshly-cut thread. Write for descriptive booklet and name of near-by supply-house.

THE OSTER MFG. CO.
Specialists in Hand and Power Threading Equipment
2059 East 61st Place Cleveland, Ohio

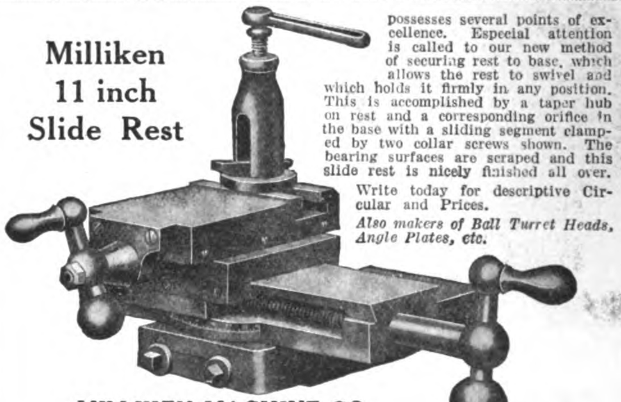
"We think that our new tool paid for itself on one hot water heating job in our office in time saved and in perfect threads and tight joints.
A new owner in Ashtabula.

The Seneca Falls "Star" Lathe Agents

Ogden R. Adams, Rochester, N. Y.; Ogden R. Adams, Buffalo, N. Y.; Blackman-Hill-McKee Co., St. Louis, Mo.; Cameron & Barkley Co., Jacksonville, Fla.; Coghlin-Kirkby Machinery & Supply Co., Toledo, Ohio; Eccles & Smith Co., San Francisco, Calif.; The English Tool & Supply Co., Kansas City, Mo.; E. L. Essley Machinery Co., Chicago, Ill.; The Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; The Lynd-Farquhar Co., Boston, Mass.; F. E. Satterlee Co., Minneapolis, Minn.; The Perine Machinery Co., Seattle, Wash.; F. C. Richmond Machinery Co., Salt Lake City, Utah; The Sherritt & Stoer Co., Philadelphia, Pa.; Smith-Booth-Usher Co., Los Angeles, Calif.; The Gang Machinery Co., Cincinnati, Ohio; The Brownell Machinery Co., Providence, R. I.; Somers, Fitler & Todd, Pittsburgh, Pa.; Standard Machinery Co., New Haven, Conn.; Strong, Carlisle & Hammond Co., Cleveland, Ohio; Strong, Carlisle & Hammond Co., Detroit, Mich.; The Swift Machinery Co., 45 W. 18th St., New York City; The Carey Machinery & Supply Co., Baltimore, Md.; The Gulf Machinery & Ship Supply Co., Galveston, Texas; The H. A. Smith Machinery Co., Syracuse, N. Y.; The E. A. Kinsey Co., Indianapolis, Ind.

THE SENECA FALLS MFG. CO., INC.
Seneca Falls, N. Y.

Milliken 11 inch Slide Rest



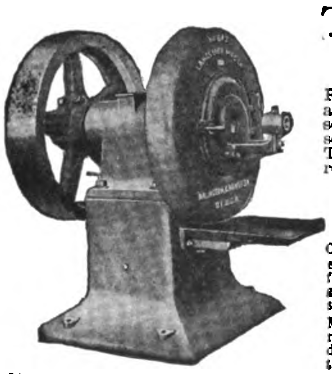
possesses several points of excellence. Especial attention is called to our new method of securing rest to base, which allows the rest to swivel and which holds it firmly in any position. This is accomplished by a taper hub on rest and a corresponding orifice in the base with a sliding segment clamped by two collar screws shown. The bearing surfaces are scraped and this slide rest is nicely finished all over.

Write today for descriptive Circular and Prices.

Also makers of Ball Turret Heads, Angle Plates, etc.

MILLIKEN MACHINE CO.
West Newton, Mass., U. S. A.

The Skill is All in the Machine



ROTARY SWAGING is the modern and economical method of forming solid or tubular circular metal sections without waste of stock. The Langelier Swaging Machine reduces or tapers to a circular section, square, round, hexagonal or similar shapes, hot or cold. We build special swaging equipment for Tungsten Filament Wire.

Our policy is to equip the machine in every detail with work holding and feeding devices that will enable them to give the most efficient service with unskilled help at a low upkeep cost.

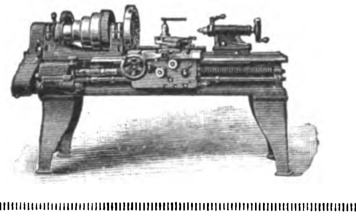
Machines built to date have capacity ranging from a pin point to 2½ in. diameter on solid stock and to 6 in. on tubing.

LANGELIER MFG. COMPANY
Arlington, Cranston, R. I., U. S. A.

STEINLE TURRET LATHES

A modern high power, high duty production turret Lathe for bar or chucking work. Designed and built sufficiently powerful and rigid to enable use of greatest number of multiple cutters and thus insure rapid, accurate and economical work. Why not write us for full particulars.

STEINLE TURRET MACHINE CO.
MADISON, WIS. U. S. A.



CHAMPION
QUALITY
ACCURACY
PRICE
LATHES

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Sidney Service Always

Lathes designed and built to give the right kind of service.

Lathes sold with advice. Particulars on request.

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Size of Lathe	Standard Change Gear	Quick Change Gear
9 in. x 3 ft. Lathe	$176.00	$216.00
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13 in. x 5 ft. Lathe	304.00	354.00
15 in. x 6 ft. Lathe	376.00	431.00
16 in. x 8 ft. Lathe	452.00	512.00
18 in. x 10 ft. Lathe	656.00	721.00
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24 in. x 14 ft. Lathe	1,254.00	1,353.00

SOUTH BEND LATHE WORKS
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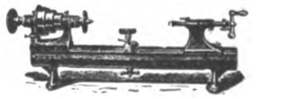
Precision Bench Lathes



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STARK TOOL CO., Waltham, Mass.
Originators of the American Bench Lathe ***Established 1862***

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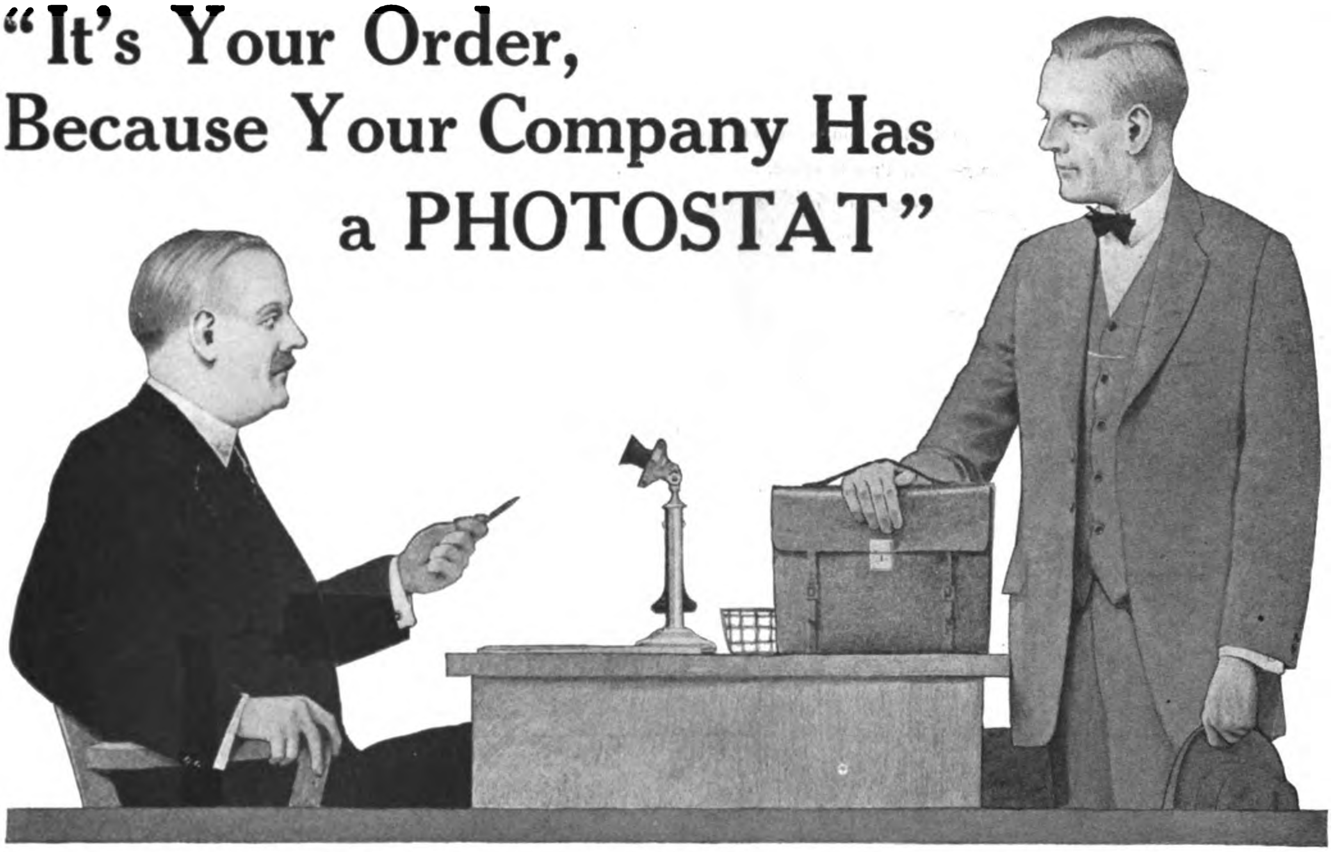

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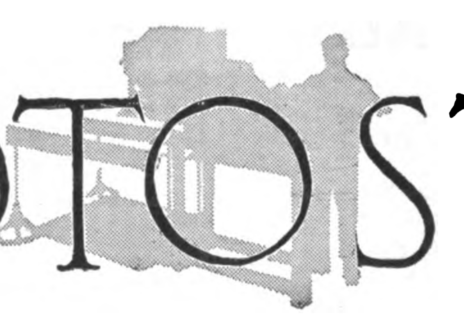
Executive Office: Providence, R. I.



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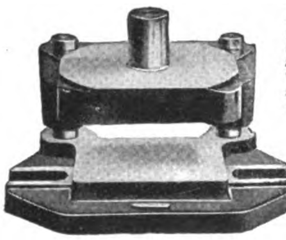

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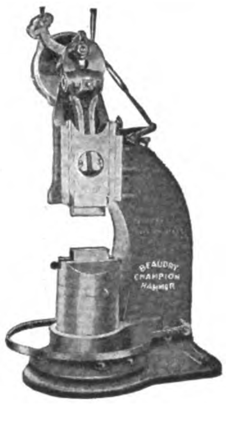

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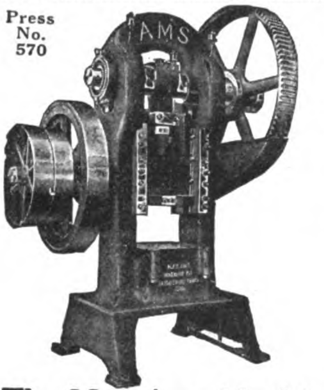

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What You Should Expect From Your Pulleys

is told in a book entitled, "Getting Maximum Pulley Efficiency." On request, a copy will be mailed to you at once.

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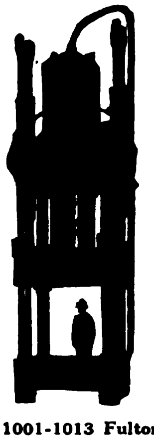

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UP TO 3000 TONS
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Special Machinery Built to Order

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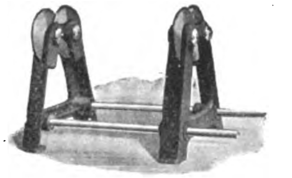

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Sheet Metal Working Machinery

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Guards for Punch Presses
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THE LONG AND ALLSTATTER CO.
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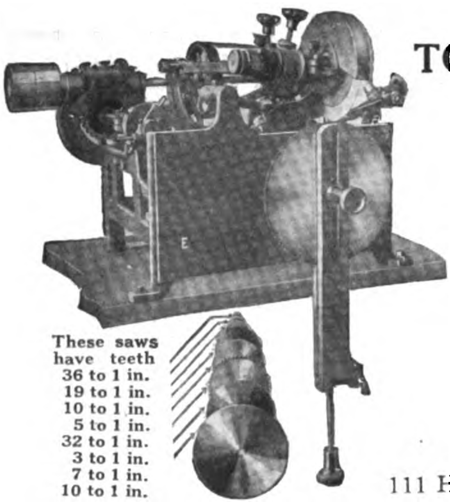
THE QUALITY LINE



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MODEL E—SHARPENS ALL METAL-CUTTING SAWS

No other machine approaches in accuracy the work this machine does in salvaging MILLING, SLITTING, SCREW SLOTTING AND COLD SAWS.

IT DOES NOT DEPEND ON THE SHAPE OF THE EDGE OF THE GRINDING WHEEL TO FORM THE SHAPE OF THE TOOTH.

FIGURE THE MONEY SAVED

Over attempts at hand work or throwing away

RESHARPENED SAWS WILL CUT 40% FASTER

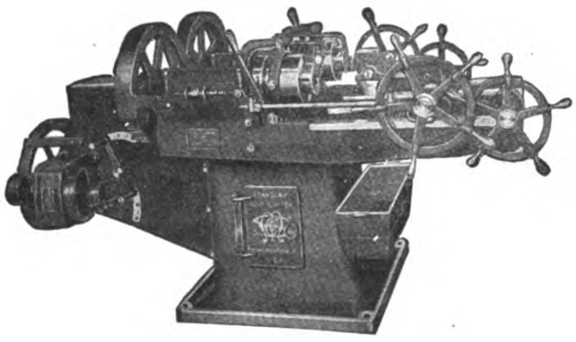
Write for Specification Sheets and Catalog

THE WARDWELL MANUFACTURING CO.

111 Hamilton Ave. **Combination Band Saw Filers and Setters, Metal Cutting Band Saw Grinders and Filers, Circular Saw Filers, etc.,etc.** Cleveland, Ohio

The "STANDARD" Double Bolt Cutter

Column and headstock are cast in one piece, assuring permanent alignment and rigidity. Will stand up and do perfect work under the most trying conditions. Six sizes: 1½ in., 2 in., 2½ in., 3 in., 3½ in., 4 in.



Improved Die Head and Control Exclusive and Superior Design

All parts strong and substantial yet micrometer adjustment or set is so sensitive that bolts may be cut *over* or *under* size and dies set to again cut *exact* size—at will of operator, while machine is running, adjustment not affected by opening or closing of dies. Feed is automatically stopped when desired length is cut.

Circular gives details—write for it.

The Universal Machine Company
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HIGLEY

Cold Metal Saw

Catalog will be sent on application to

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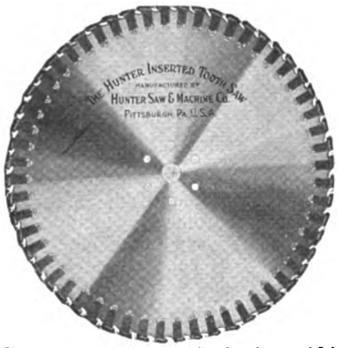

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All Types of Circular Saws for Cutting Metal

Inserted tooth saws, solid tooth milling saws made of chrome alloy, semi-high and hign-speed steels, hot saws, friction discs. Saw sharpening machines.

Have you tried our "Beskut" semi-high speed milling saws? They will cut costs on hard jobs.
We also manufacture and carry in stock a full line of rivet sets and chisel blanks.

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Continual Savings

You save in a dozen different ways when you cut your rods, bars and sheets on the

HERCULES
Shears and Rod Cutter
Plain or Combination
Details in Catalog No. 2

Nos. 1, 2 and 5 **W. A. & C. F. Tucker, Hartford, Conn.** Nos. 3 and 4

"MILFORD" HACK SAW BLADES

"Go By The Name"

Sample sent on request
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"True to the Name"

Made of the finest tungsten steel by specialists of many years' experience. Specify "QUALITY" on your next order and settle your Hack Saw Problem.

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"Sensible" Type Drafting-Room Furniture and Wooden Goods

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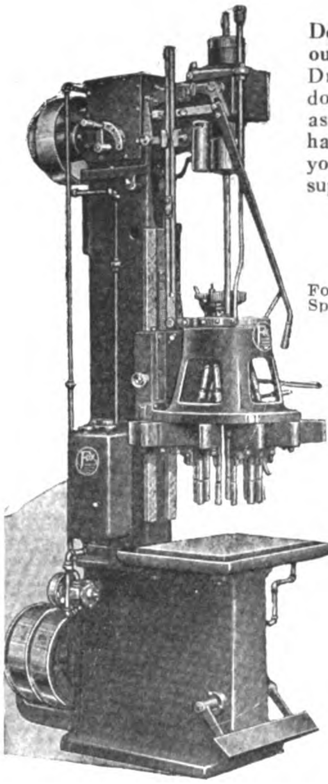
"Operating Time Is Profit-Making Time"

LET SERVICE TESTS SPEAK FOR THEMSELVES



Do **not be content to accept our statements.** Test our Drills yourself. Others have done it and become enthusiastic about them. When you have seen Fox Drills at work, you will be convinced of their superior qualities.

Automatic Tapping Machine

Fox D-12 Automatic Multiple Spindle Tapping Machine here illustrated Positively breaks all previous multiple tapping methods and effects the greatest saving ever known in multiple tapping.

MULTIPLE DRILLING MACHINES FOX

We manufacture a complete line of multiple drilling and tapping machines.

Send for details.

Fox Machine Company
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INSERTED TOOTH
MILLING SAWS

Making high-grade saws for 50 years showed us the need of a saw as fine in pitch as the solid tooth variety; but with the advantages of an inserted high-speed tooth. The development of Huther Brothers' Fine Pitch Type Inserted Tooth Milling Saw was the result. It cuts small rounds and flats or structural steel, rails, frogs, and switches. Send for one on approval—return it at our expense if unsatisfactory.

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Saw Makers for more than 50 Years
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Steel Stamps and Marking Dies

Mark Better—Last Longer

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The Noble & Westbrook Mfg. Co.
"Improved Marking Devices"
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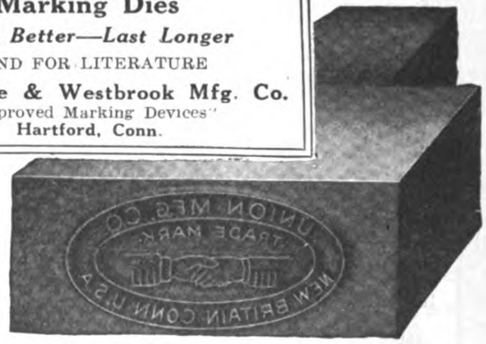

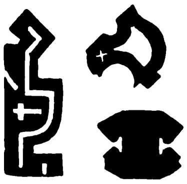

Gray's Sheet Metal Cutter Cuts Shapes Like These

Made in four sizes for cutting shapes from 1/8, 3/16, 1/4 and 5/16-inch plate.

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Peerless HIGH SPEED

HACK SAW MACHINES

Unequaled for fast, accurate, economical cutting of bar steel. The new UNIVERSAL SHAPING SAW will do your hack sawing, also many slotting, shaping and other operations.
Peerless features—Overbalanced saw frame—Automatic lift and positive feed control—Greater production with less blades.

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HACK "STERLING" SAWS

Diamond Saw & Stamping Works, Buffalo, N. Y.

Lea Simplex Cold Saws

Fast—Easy to Operate—Large Capacity
Minimum Waste of Stock

Designed, Manufactured and Sold by
The Earle Gear & Machine Co.
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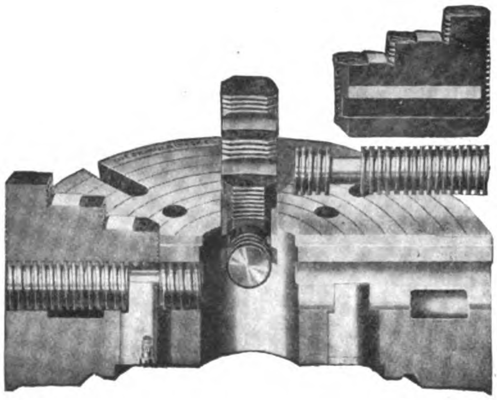
SKINNER STEEL BODY INDEPENDENT CHUCK

Powerful—Sturdy—Dependable—Accurate



Where exceptional gripping power is required—where heavy cuts are often necessary and large pieces are held, this type of chuck will render most satisfactory service.

Although the Skinner Steel Body Chuck has been in use for years, we have never known of one breaking in service. It is the heaviest, strongest Independent Chuck made.

BODY—CAST STEEL
JAWS—EXTRA WIDE
ADJUSTING SCREWS—
LARGE DIAMETER

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Established 1887

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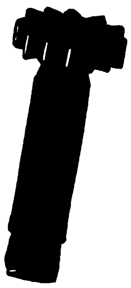
Wearever Woodruff

Keyway Cutters and Special Chucks



This Woodruff Cutter is all high-speed steel, nothing taken out, nothing forced in. Provided with the squared shank which facilitates quick, rigid chucking.

The Wearever Positive Drive Chuck is broached to fit the square, centers by the shank and drives by the square so that the cutter always runs true.

Chuck is used like a socket and fits into the spindle like a drill. Cutters can be changed in a few seconds.

Write today for full description.

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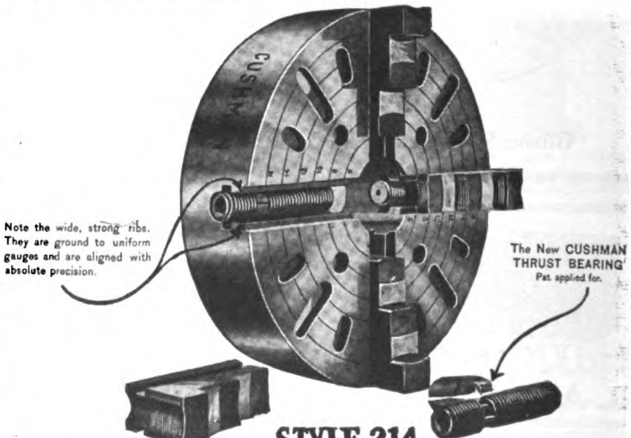
BUILDING FOR THE FUTURE

On the Experience of the Past

The Cushman Chuck Company has been building for the future for sixty years. It is doing it to-day. This is the reason that, when the need appears for a better holding device, there is a Cushman Chuck ready to meet it.



STYLE 214

"The Incomparable"

THAT NEW STEEL CHUCK

Ask your dealer about it.

THE CUSHMAN CHUCK CO. HARTFORD CONN., U.S.A.

Announcement

IN future issues, this page will be devoted to suggestions for the improvement of manufacturing methods.

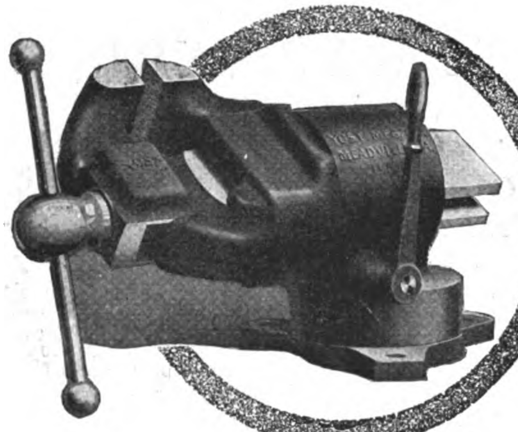
Hole drilling and tapping operations have stepped beyond the common place and the progressive shop manager knows that satisfying dividends result from the careful selection of modernly-equipped

Stationary and Portable Drilling Machines
Tapping Machines Centering Machines
Tap and Drill Grinders
Flexible Shafts

and all types of Drilling and Tapping Equipment

THE JACOBS MFG. COMPANY, HARTFORD, CONN.

This advertisement is published in the interests of good Drilling Equipment by the makers of the Jacobs Chuck



The Flexibility of the Human Hand

Rivalling the flexibility of the human hand, YOST VISES enable you to put all the necessary finishing touches to a piece of work at one gripping—saving time, ensuring accuracy and preventing possible damage through frequent grippings.

This is the vise you need. Write for specifications.

Yost Vises

Yost Manufacturing Co.
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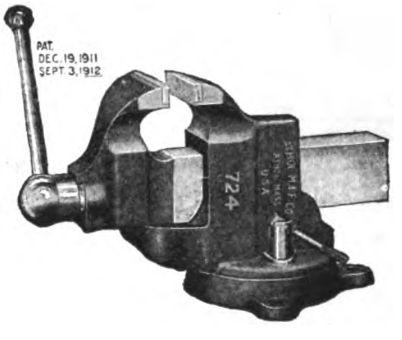
Athol-Starrett Vises

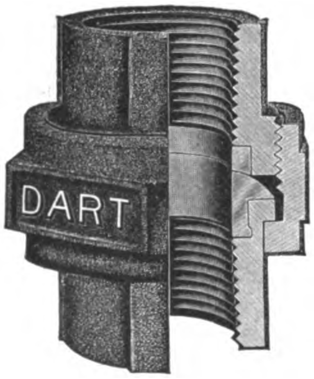


Starrett Ratchet Handle Machinists'

The Starrett Patented SWIVEL BASE—used on all ATHOL-STARRETT swivel base vises—is made with a corrugated runway and corrugated clamp bolt head which gives it a posititve lock in any position the full diameter of the circle. In tightening the clamp bolt nut it is necessary to use only a slight pressure—not more than that of two fingers—on the lever in order to secure the body of the vise to the base so that it will not move.

Write for Catalogue 35

Athol Machine & Foundry Co.
Athol, Mass., U. S. A.



Perfectly Tight Under High Pressure

Dart non-corrosive bronze seats accurately ground together make Dart Unions non-leaking.

A free sample on request

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The Fairbanks Co., Sales Agents
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Williams' Superior Drop-Forged Clamps

11 Patterns, in a wide range of sizes, for every clamping purpose.

DROP-FORGINGS
often cheaper than castings
—always far superior

J. H. WILLIAMS & CO.
"The Drop-Forging People"

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35 Richards St.

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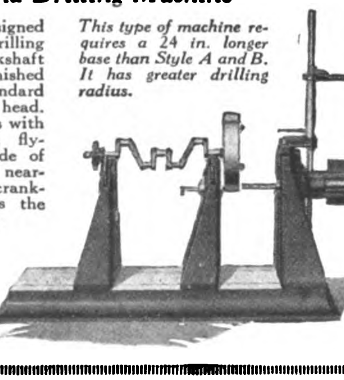
ROCKFORD STYLE "C"

Balancing and Drilling Machine

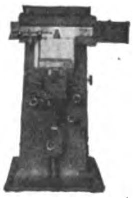
This machine was designed for balancing and drilling flywheels with crankshaft attached. It is furnished with an extra standard which carries the drill head.

In drilling flywheels with crankshaft attached, flywheel is hung outside of balancing standard nearest drill head. The crankshaft counterbalances the overhanging flywheel.

This type of machine requires a 24 in. longer base than Style A and B. It has greater drilling radius.



Rockford Tool Co.
Rockford, Illinois



Martin Marking Machines

Use this Hydraulic system for marking your Radio Panels and Parts. A tremendous saving.

Write for details and sample marking.

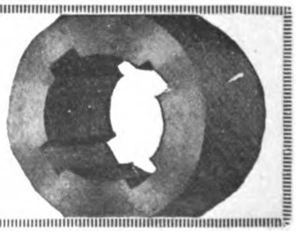
MARTIN MACHINE CO., Inc.
Turners Falls, Mass., U. S. A.

Have Us Broach It

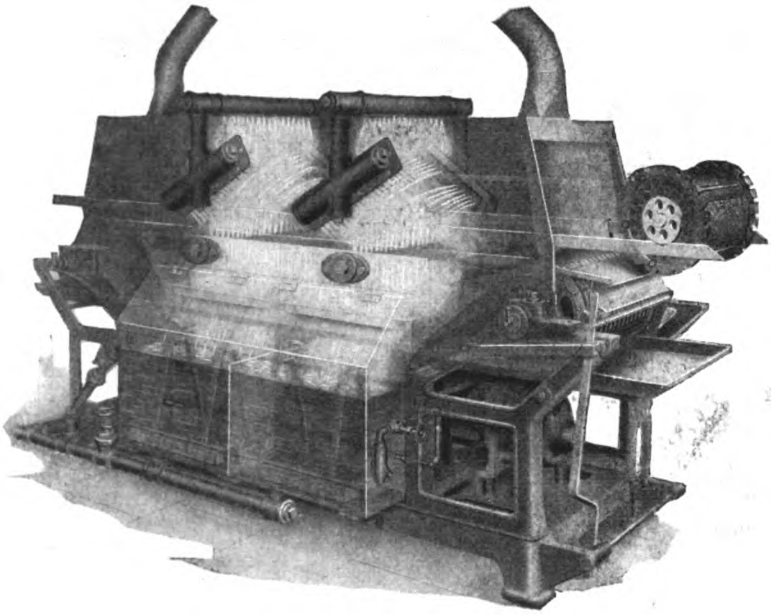
Broaching cuts cost on keyways, splines, oil grooves, gear teeth, and countless regular or irregular shaped holes. Send your problems to the originators of commercial Broaching

Remember—"Lapointe of Hudson"

Lapointe Machine Tool Co.
Hudson, Mass.



Cleaner Parts Mean Cleaner Profits



Thoroughly cleaned parts machine more readily and are a direct aid to speed in assembling. Discard your push and dip-pail methods and get cleaner parts at less cost by using the

COLT AUTOSAN

Trade Mark Registered U. S. Pat. Office

***Metal Parts* Washing Machine**

It cleans all sorts of metal parts up to 14 in. x 20 in. size, and any length, removing every vestige of oil, chips and grit. With one man it will do the work of several and do it better.

The parts travel through the machine on an automatic conveyor and may be loaded singly, in trays, or small tumbling barrels—according to size.

A series of eight forceful sprays flood every surface of the parts with cleansing solutions or the first series of sprays may be used for the solution and the final for a hot water rinse.

Economy is the outstanding factor in the "Autosan" as its automatic operation requires the supervision of but one man and the power is derived from a 2-hp. motor.

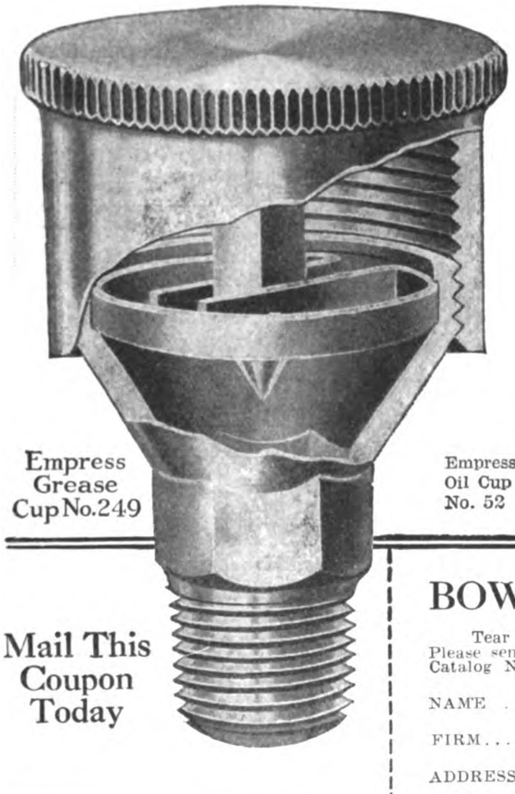
The Circular will prove conclusively that this machine is needed in your plant.

Colt's Patent Fire Arms Mfg. Co. Hartford, Conn.

GREASE CUPS!

Empress Cups Insure Perfect Lubrication for Your Machines

They keep the dirt out — let the lubricant in; small but important accessories, they solve the lubrication problem for the machine designer. Specify Empress lubricators.



Empress Grease Cup No. 249

Empress Oil Cup No. 52

The large cut shows the Empress Grease Cup No. 249; the small one Empress Oil Cup No. 52—two of our most popular cups. Check the one you want (both if you're interested) and we'll send samples.

REG. U.S. PAT OFF.

Mail This Coupon Today

BOWEN PRODUCTS CORP., Auburn, N. Y.

Tear out and attach this coupon to your letterhead.
Please send me sample of your Empress Grease Cup No. 249 ☐ Empress Oil Cup No. 52 ☐ and Catalog No. 101-H of your entire list.

NAME .... TITLE ....

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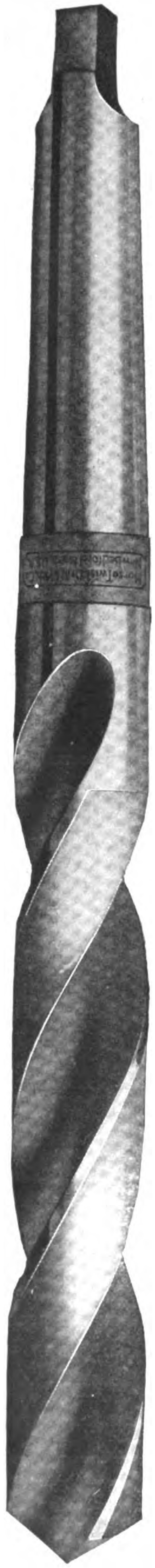
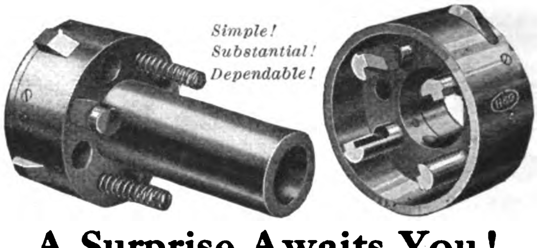
When You Find a Drill Stamped "MORSE" it is a Guarantee of Uniform Quality and Accuracy



Morse Twist Drill
& Machine Co.,
New Bedford, Mass., U. S. A.



A Surprise Awaits You!

WHEN you send for one of the H & G dieheads and put it to work on one of your own machines, operated by one of your own men, a surprise awaits you.

You will be amazed at the way this diehead cuts threads—the speed, the accuracy, the toolroom quality of the work.

But the reason, like the explanation of any successful invention, is simple. H & G dieheads are designed on principles that are fundamentally and mechanically correct. The construction is substantial and strong, the operation sure and certain.

The diehead closes, the stock goes in. The thread is cut—clean, smooth, perfect. *Click!* The diehead flies open, ready for the next piece.

This performance goes on day after day, hour after hour, without a halt on account of trouble, with longer intervals between grindings of the chasers than you ever thought possible. It's the tough, staysharp character of H & G chasers that gives this service.

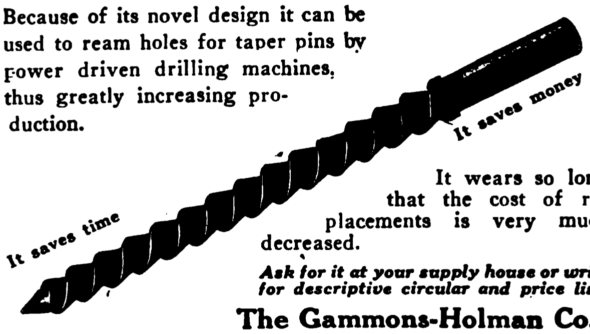
But, better than a yard of talk is a shop test, the harder the better. We are ready to go the limit to show what real efficiency in thread-cutting means in dollars and cents to you. Get a letter off to us this very day!

THE EASTERN MACHINE SCREW CORPORATION
20-40 Barclay Street, New Haven, Connecticut
Styles and sizes available for any machine on which threading is done. Prompt deliveries from factory by Parcel Post.

H&G

The Gammons Taper Pin Reamer

Because of its novel design it can be used to ream holes for taper pins by power driven drilling machines, thus greatly increasing production.



It wears so long that the cost of replacements is very much decreased.

Ask for it at your supply house or write for descriptive circular and price list.

The Gammons-Holman Co.
Manchester, Conn.

1876 TRUMP DRILL CHUCK 1922

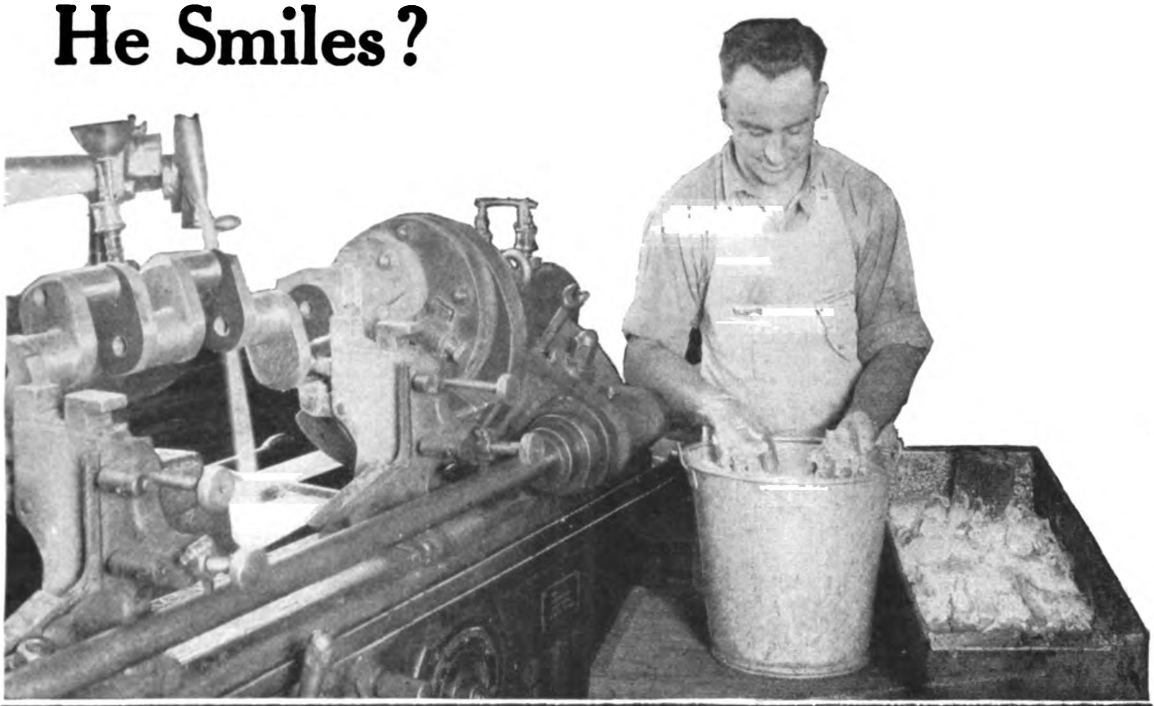
HIGH QUALITY—LOW PRICE

Three Sizes: ⅛-in., ¼-in., ⅜-in. Descriptive lists on application.

Trump Bros. Machine Co., Mfrs.
Wilmington, Delaware
Chas. Churchill & Co., London, Eng.

Only reliable products can be continuously advertised.

Do You Know Why He Smiles?



EC OMY

ECONOMY

TRADE MARK REG. U.S. PAT. OFF.

EC OMY

GRINDING LUBRICANT

In shops where the product must measure up to unusually high standards, the mechanics are fully appreciative of the benefits derived from the use of proper coolants and lubricants.

Usually when a machinist gets up to his elbows in a "mess," he does other things than smile. But **Economy Grinding Lubricant** has the same effect on the man who mixes it as on the job it helps to perform—it gives the fullest measure of satisfaction.

The above view was taken in the plant of a prominent builder of airplane motors. The operator of the crank grinder is mixing up a new batch of **Economy.** He knows that by keeping an unfailing supply of **Economy** on hand, he will have little to fear as to the results of his daily efforts.

To quote his own words relative to **Economy:** "It is the best grinding Lubricant we have ever used. It not only enables me to produce better crankshafts, but it gives similar satisfaction on scores of other jobs turned out in this plant."

Economy Grinding Lubricant has been used in this plant for a number of years. If it proves to be the best on this particular work, why can't you see its advantages on your own?

If you do grinding—surface, edge, cylindrical, internal, centerless—large or small—you are losing money if you ignore the economy of "ECONOMY" GRINDING LUBRICANT. We believe we can prove it with a 5-lb. sample—it's FREE. Write us today.

The White & Bagley Company, Worcester, Mass.

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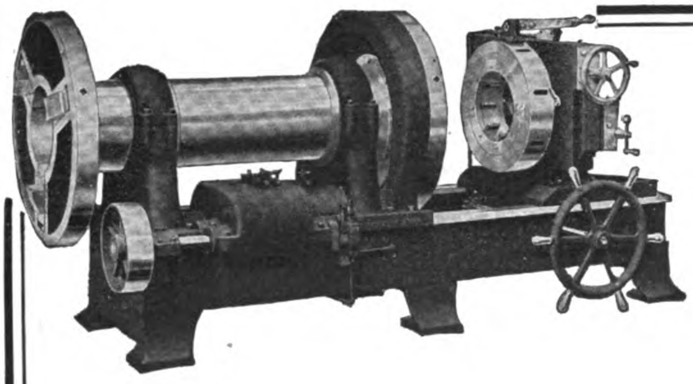
PEERLESS B&K DUPLEX D.Q.



Follow The Leaders

When you buy a Bignall & Keeler Machine you are buying the choice of those who make it their business to know pipe machines; they who are wise to the type which means long life and unfaltering service. If the big users of pipe machines in the country pick B & K machines, you run no risk in following their lead.

Eighty-five concerns in one city bought two hundred and thirty machines, and sixty-five of the eighty-five placed repeat orders. One placed five repeat orders.

Send for the Catalog.

Bignall & Keeler Machine Works

Edwardsville, Illinois

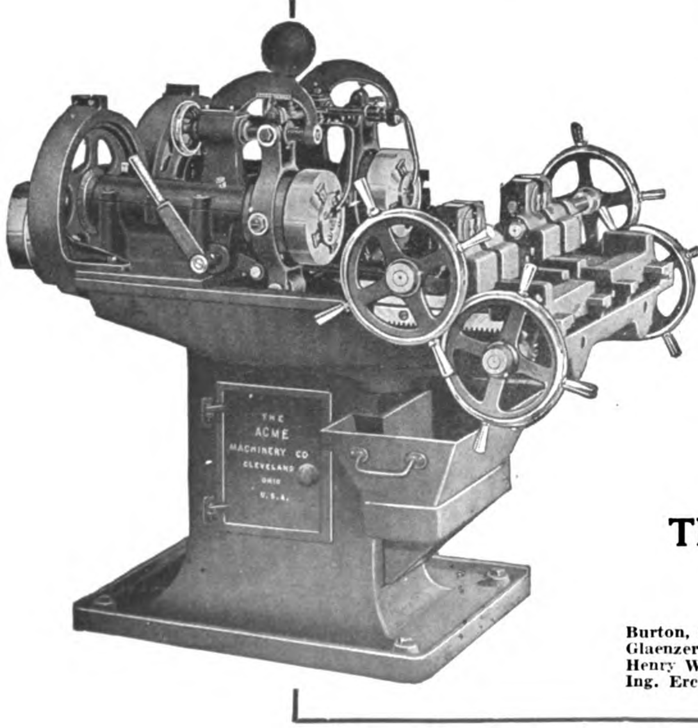
Sales Agents: Manning, Maxwell & Moore, New York, N. Y.

Chicago Philadelphia Boston St. Louis Pittsburgh Cleveland New Haven Cincinnati Buffalo Syracuse Detroit Milwaukee San Francisco Seattle

PEERLESS B&K DUPLEX D.Q. PEERLESS B&K DUPLEX D.Q.

ACME BOLT CUTTER

It's poor business to pay rent when you can own your own home



It's just as poor business to buy your square, hex and tee-head bolts on the outside when you can cut them in your own plant with an **ACME Bolt Cutter** and save money.

Even very small lots can be handled economically, due to the ease with which dies can be changed and the machine adjusted to new sizes.

The superiority of the **ACME Die Head** with its latest improved micrometer die adjustment assures accurate threads. The durability of the chasers is well established—all wearing parts being made of tool steel accurately ground and tempered to just the right degree of hardness.

ACME Bolt Cutters are made in single to quadruple head types for ¼ in. to 6 in. work. Write today for catalog giving details of our complete line.

The Acme Machinery Company

Cleveland, Ohio, U. S. A.

FOREIGN AGENTS:

Burton, Griffiths & Co., Ludgate Square, Ludgate Hill, London, England.
Glaenzer & Perreaud, 18 Faubourg du Temple, Paris, France.
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The monthly magazine of the electrical trade. It gathers from the field new selling ideas and effective commercial and financial methods and disseminates these facts among those who sell, manage and finance electrical appliances, equipment, supplies or service. $2.00 per year.

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The engineering and business newspaper of the electric railway industry. It thoroughly covers corporate policies, construction, managerial, operating and maintenance methods, legal and financial news, equipment and supplies and all phases of public relations. $4.00 per year.

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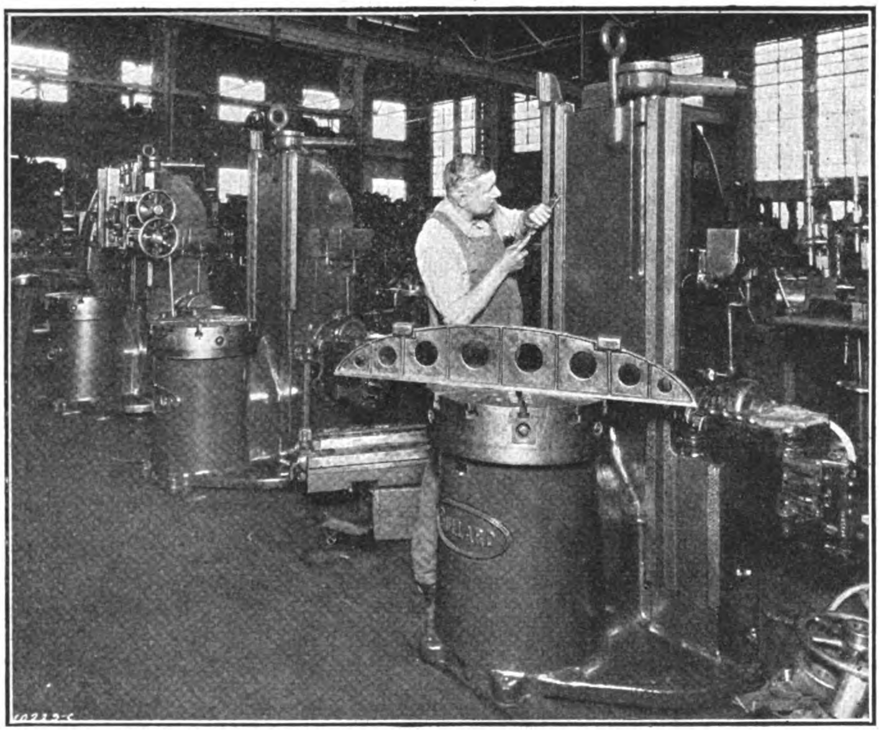
ReMANUFACTURED -(ORIGINATED BY US)- MACHINE TOOLS

REG. U. S. PAT. OFFICE

GUARANTEE: If for any reason a machine bought of us is not satisfactory, return the same within thirty days from date of shipment, freight prepaid, and we will refund the purchase price in full; no excuses necessary.



THIS is a Bullard Vertical Turret Lathe in the course of ReManufacture.

The ways—whether they need it or not—are thoroughly examined and hand-scraped to *absolute accuracy.* Every bearing surface—every moving part—is gone over and brought, as near as possible, to its original condition.

So, when the machine is offered for sale, the buyer is protected by the Hill, Clarke Guarantee. It is his insurance of the productive value of the tool.

The Green List*

of Guaranteed ReManufactured Machine Tools

WRITE FOR A COMPLETE COPY

LATHES

1—13-in. x 5-ft. Willard, semi-Q.C.G.
1—15-in. x 6-ft. Sidney, Q.C.G.
1—16-in. x 6 ft. American Q. C. C.
1—16-in. x 6-ft. Flather, Q.C.G.
8—17-in. x 6-ft. LeBlond Mfg. Auto.
1—18-in. x 10-ft. Mueller, Q.C.G.
1—18-in. x 8-ft. Lodge & Shipley, Q.C.G.
4—18-in. x 8-ft. Mueller, Q.C.G.
2—18-in. x 8-ft. Lehman, Q.C.G.
20—19-in. x 8-ft. LeBlond, Heavy, Q.C.G.
13—20-in. x 8-ft. LeBlond, Q.C.G.
69—20-in. x 8-ft. American, Q.C.G.
5—20-in. x 12-ft. American, Q.C.G.
5—20-in. x 16-ft. American, Q.C.G.
3—20-in. x 10-ft. Lodge & Shipley Q.C.G.
25—21-in. x 10-ft. Le Blond, heavy, Q.C.G.
1—24-in. x 10-ft. Hendey, geared hd.
1—24-in. x 10-ft. American, gd. head.
8—25-in. x 10-ft. LeBlond, heavy, Q.C.G.
28—26-in. x 10-ft. Niles-Bement-Pond
70—26-in. x 10-ft. Bridgeford, Q.C.G.
22—26-in. x 12-ft. Bridgeford, Q.C.G.
2—26-in. x 16-ft. Bridgeford, Q.C.G.
2—26-in. x 18-ft. Bridgeford, Q.C.G.
2—26-in. x 20-ft. Bridgeford, Q.C.G.
6—30-in. x 11-ft. American, gd. hd.
1—30-in. x 20-ft. American, gd. hd.
19—32-in. x 12-ft. Pittsburgh, Q.C.G.
2—36-in. x 14-ft. Johnson, triple gd.
1—36-in. x 19-ft. Johnson, triple gd.
15—36-in. x 30-ft. Pittsburgh, gd. hd.
1—Each 36-in. x 36-ft. and 42-ft. LeBlond, Q.C.G.
4—36-in. x 37-ft. Niles-Bement-Pond triple geared.
2—45-in. x 24-ft. Pond, Triple Gd.

MILLERS

1—No. 0 Brown & Sharpe.
1—No. 38 Chicago Small.
2—No. 1 Brown & Sharpe Plain.
1—No. 1½ Cincinnati Plain.
1—No. 1½ Brown & Sharpe Plain.
2—No. 20 Ohio Plain.
1—No. 2 Ohio Plain.
1—No. 24 Ohio Universal.
8—No. 2 Kempsmith Plain.
2—No. 2 Brown & Sharpe Plain.
2—No. 2-A Brown & Sharpe Universal
1—No. 2-B Milwaukee Plain S.P.D.
1—No. 3 Brown & Sharpe Plain.
12—No. 3 Kempsmith Plain.
1—No. 4 Cincinnati Universal SPD
1—No. 4 LeBlond Plain.
4—No. 4 Cincinnati Plain, Cone.
2—No. 4 Cincinnati, Plain, S.P.D.
1—No. 3 Cincinnati Hi-power Vert.
1—17-in. x 10-ft. Beaman & Smith 3 hds.
1—No. 1½ Newton Duplex.
1—24-in. x 6-ft. Ingersoll Slab.

GRINDERS

1—Detroit Centerless.
3—No. 1 4 x 20-in. Morse Plain.
5—6 x 32-in. Norton Plain.
1—No. 1 10 x 20-in. Bath Universal.
1—No. 2 Brown & Sharpe Universal.
1—10 x 36-in. Thompson Universal.
2—No. 3 Landis Universal.
1—No. 2 12 x 36-in. Cincinnati Univ.
12—10 x 36-in. Norton Plain.
1—10 x 50-in. Norton Plain.
1—10 x 72-in. Norton Plain.
2—12 x 36-in. Modern Plain.
2—12 x 36-in. Landis Plain.
1—12 x 96-in. Landis Plain.
4—14 x 50-in. Norton Crankshaft.
8—14 x 50-in. Norton Plain.
5—14 x 72-in. Norton Plain.
1—16 x 72-in. Norton Plain.
1—20 x 96-in. Norton Plain.
1—No. 2 Bath Surface.
1—8 x 48-in. Thompson Surface.
1—No. 3 Brown & Sharpe Surface.
1—No. 22 Pratt & Whitney Vertical.
1—30-in. Blanchard Vertical Surface.
2—14-in. Pratt & Whitney Surface.
1—No. 2 Oesterlein Univ. Cutter.
3—No. 70 Heald Internal.

BORING MILLS

13—24-in. Bullard Vert. Turret Lathes
1—30-in. Bullard Vertical.
1—30-in. Gisholt Vertical.

BORING MILLS (Continued)

1—36-in. Bullard Vertical.
1—37-44-in. Colburn Vertical.
1—42-in. Gisholt Vertical, 2 hds.
1—48-in. Colburn Vertical.
1—60-in. Bullard Vertical.
3—72-in. Cincinnati Vert.
1—72-in. Betts Boring Mill.
1—10-ft. Niles Vertical.
1—4-in. bar Niles Horizontal.
1—Beaman & Smith Horiz., 2 hds.
1—2-spdl. Espen-Lucas, 2 hds.
1—3A Universal Horizontal.
3—Foote-Burt Horizontal.
1—No. 5 Defiance Horizontal.
1—No. 3 Beaman-Smith Eng. and Frame Boring

SHAPERS AND PLANERS

1—15-in. Potter & Johnston.
1—16-in. Queen City, Back Geared.
10—16-in. Walcott, Back Geared.
1—17-in. Smith & Mills, Bk. Gd S.P.D.
7—20-in. Walcott, Back Geared.
7—24-in. Walcott, Back Geared.
2—26-in. Niles-Bement-Pond, B.G.
1—24 x 24-in. x 12-ft. Whitcomb.
1—30 x 30-in. x 10-ft. Woodward & Powell, 3 hds.
1—30 x 30-in. x 10-ft. Cincinnati.
2—36 x 13-in. x 14-ft. Niles-Bement-Pond, Frog and Switch.

**This is only a small part of the Green List.*
If any tool you need is not included here, write.

HILL, CLARKE & CO. OF CHICAGO
649 Washington Boulevard

SHAPERS and PLANERS (Continued)

1—36 x 36-in. x 10-ft. Bickett, 3 hds.
1—38 x 30-in. x 8-ft. Cincinnati, 2 hds.
1—56 x 56-in. x 10-ft. Gray.
1—60 x 48-in. x 10-ft. Gray.

TURRET AND SCREW MACHINES

2—No. 00 B & S. Auto.
1—No. 0 B. & S. Auto.
1—No. 2 B. & S. Auto.
1—No. 2 B. & S. Semi Auto.
12—6-A Model 2 Potter & Johnston.
1—1¼-in. Gridley Auto. Screw.
2—No. 75 National-Acme Automatic
1—1-in. Pratt & Whitney.
13—1-in. Warner & Swasey, No. 2.
5—1-in. Foster, No. 2.
4—1¼-in. Foster, No. 3.
3—1½-in. Warner & Swasey, No. 4.
5—1½-in. Wood No. 4.
3—No. 8 Warner & Swasey.
1—2-in. Brown & Sharpe, No. 6.
2—2-in. Pratt & Whitney.
2—3 x 36-in. Jones & Lamson.
1—3 x 36-in. Acme.
16—18-in. Libbys.
19—24-in. Gisholt.

UPRIGHT DRILLS AND RADIALS

1—No. 310 Baker.
2—No. 11-12 spdl. Pratt-Whit. Mult
2—Type 11, 8-spdl. Natco Multiple.
1—41 Natco Multiple.
1—1-spdl. Henry & Wright.
1—2-spdl. Henry & Wright.
4—4-spdl. Allen.
16—6-spdl. Allen.
3—No. 6-B Henry & Wright Sensitive.
6—22-in. Barnes Sliding Head.
1—25-in. Silver Sliding Head.
1—25-in. Barnes Camel Back.
5—25-in. Barnes Sliding Head, P.F.
1—24-in. Barnes Camel Back.
1—24-in. Barnes Sliding Head.
1—28-in. Cincinnati-Bickford.
1—34-in. W. F. & J. Barnes, slid. hd.
3—36-in. Cincinnati, Sliding Head.
1—40-in. Cincinnati, Sliding Head.
3—3-ft. American Sensitive.

GEAR CUTTERS AND HOBBERS

10—No. 1 Farwell Gear Hobbers.
1—No. 00 Schuchardt & Schutte Gear Hobber.
4—No. 1 Schuchardt & Schutte Gear Hobbers.
2—Lees-Bradner Gear Hobbers.
4—18-in. Gould & Eberhardt Hobbers.
2—26-in. Brown & Sharpe.
1—30-in. Flather Gear Cutter.
2—36-in. Cincinnati Gear Cutters.
3—36-in. Gould & Eberhardt Hobbers
7—No. 6 Fellows Gear Shapers.
1—No. 612 Fellows Gear Shaper.
1—36-in. Gleason Spur and Bevel Gear Shaper.

SECOND-HAND MACHINE TOOLS

DRILLS

2—sp. Avey, ball bearing.
2—sp. Henry & Wright, ball bearing.
3—sp. Taylor & Fenn, plain bearing.
4—sp. Francis Reed, plain bearing.
20-in. Prentice Br. sl. hd., BG., PF.
25-in. Snyder sl. hd., BG., PF., tapping att.
32-in. Cinti. Bick. H.S. shaft drive, speed box, tapping att.
42-in. Cinti. Bick. sl. hd., BG., PF., tapping att.
No. 11 Natco multiple sp.
No. 30 Bausch multiple sp. tapping att.
3-ft. Mueller pl. radial, tapping att.
3-ft. No. 0 Bickford pl. radial tapping att.
5-ft. Dreses pl. radial, tapping att.
4-ft. Cinti. Bickford pl. radial tapping att.

BORING MACHINES

No. 2 Beaman & Smith, floor type, horiz. arr. M.D.
24 in. Colburn turret head, vertical.
38 in. Niles, 2 reg. heads, vertical.
51 in. Niles, 2 reg. heads, vertical.

SHAPERS AND PLANERS

14-in. Springfield Crank Shaper.
16-in. Gould & Eberhardt crank, back gear shaper.
20-in. Davis crank, back gear shaper.
24-in-26-in. Gould & Eberhardt, crank back gear, shaper.
24-in. Stockbridge Crank, back geared Shaper.
15-in. and 24-in. Hendey Friction Shapers.
22-in. x 22-in. x 5-ft. Lathe & Morse, 1 head.
24-in. x 24-in. x 6-ft. Flather Planer, 1 hd.
24-in. x 24-in. x 8-ft. Cincinnati Planer, 1 hd.
36-in. x 36-in. x 12-ft. Pond Planer, 2 hds.
36-in. x 36-in. x 12-ft. Cincinnati Planer, 4 hds.
48-in. x 48-in. x 15-ft. Sellers Planer, 3 hds.
72-in. x 40-in. x 10-ft. Pond planer, 2 hds.
60-in. x 40-in. x 12-ft. Pond planer, 2 hds.
66-in. x 60-in. x 30-ft. Bement Planer, 3 hds.
96-in. x 60-in. x 12-ft. Detrick & Harvey, open-side convertible planer, 4 heads.

LATHES

7-in. x 32-in. Stark precision slide rest.
14-in. x 8-ft. Lodge & Shipley, C.R., P.C.F., Q.C.G.
14-in. x 6-ft. Mulliner, C.R., P.C.F., relieving att.
14-in. x 6-ft. Monarch, C.R., P.C.F., Q.C.G.
14-in. x 6-ft. Prentice Br., C.R., P.C.F., Q.C.G.
16-in. x 6-ft. Champion C.R., P.C.F., Q.C.G.
16-in. x 8-ft. Lodge & Shipley geared head, C.R., P.C.F., taper att.
17-in. x 8-ft. LeBlond, C.R., P.C.F., Q.C.G.
17-in. x 8-ft. Flather, C.R., P.C.F., Q.C.G.
18-in. x 8-ft. Rahn Larmon, C.R., P.C.F.
20-in. x 8-ft. American, C.R., P.C.F.
26-in. x 12-ft. Putnam, C.R., P.C.F.
32-in. x 14-ft. Hamilton, C.R., P.C.F., triple geared.
38-in. x 16-ft. Pond geared head, Q.C.G., C.R., P.C.F., arr. for M.D.
38-in. x 20-ft. New Haven, C.R., P.C.F.

GRINDERS

3-in. x 18-in. Norton plain.
6-in. x 32-in. Norton plain.
10-in. x 36-in. Norton plain.
10-in. x 30-in. Landis, plain.
12-in. x 120-in. Landis, plain.
16-in x 52-in. Landis pl. crankshaft.
No. 1 Cincinnati Cutter and Reamer Grinder.
No. 60 Heald cylinder grinder.
No. 6 Rivett Internal.
No. 11 Rivett, ball race.
Saxon Face Grinder.
10-in. Garrigus Rotary, with magnetic chuck.
No. 10 & 16 Blanchard Grinder, direct M.D. type.
18-in. and 20-in. Disc Grinders.

MILLERS

Nos. 2, 3 and 4 Cincinnati, plain.
No. 2-B Brown & Sharpe, plain.
Nos. 2-A and 5, and 9 Kempsmith, plain.
Nos. 3 and 4 Cincinnati, vertical.
Nos. 2A, C2, 4B and 5 Becker Vert.
No. 1½ Brown & Sharpe, universal.
No. 1½ 2 & 3 S. Cinti. univ.
36 in. x 10 ft. Newton Face Slab Miller.
4½ x 12 Pratt & Whitney thread milling machine.
A.C.S. Becker continuous miller.

SCREW MACHINES AND TURRET LATHES

⅝-in.-½-in. cap. Cleveland auto. Model A screw machine.
⅝-in.-⅞-in. cap. Cleveland auto. Model A screw machine.
½-in. cap Cleveland pl. auto. Model B screw mach.
1-in. cap. Cinti. Acme wire feed screw machine.
1¼-in. cap. Cinti. Acme wire feed screw machine.
1½-in. cap. Cinti. Acme wire feed screw mach.
2¼-in. cap. Cinti. Acme wire feed screw machine.
16- and 18-in. cap. Cinti. Acme univ. Fox turret lathe.
2¼-in. x 24-in. Jones & Lamson, bar or chucking turret lathe.
3½-in. x 36-in. Jones & Lamson, bar or chucking turret lathe.
3½-in. cap. Cinti. Acme univ. turret lathe.
No. 1-B Foster geared head turret lathe.

MISCELLANEOUS

No. 00 S. & S. hobbing gear cutter.
No. 000 S. & S. hobbing gear cutter.
36-in. B. & S. gear cutter.
No. 3 Lapointe broaching machine.
No. 72 Ferracute press.
No. 12 & 13 P. & W. profiling machines.
3-in. P. & W. Centering machine.
¾-in. x ¾-in. Single end punch and shear.
26-in. x 8-in. Crescent single surfacer.
2½-in. to 6-in. Merrill hand pipe machine.
American, Stewart, Gilbert and Barker furnaces.
Newton, Burr and Racine Saws.

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HENRY PRENTISS & COMPANY,
149 BROADWAY, NEW YORK, N. Y.

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For Sale by **NILES-BEMENT-POND CO., 111 Broadway, New York**

SECOND-HAND MACHINERY

Located at Our Various Factories and Stores

LATHES

9-in. x 18-in. Taper, Porter-Cable.
14-in. and 16-in. x 8-ft. Whitcomb, Q.C.
17-in. x 6-ft. and 8-ft. LeBlond Geared Heads.
20-in. x 10-ft. LeBlond Q.C.
24-in. x 24-ft. Niles.
26-in. x 10-ft. Pond, 220-v., D.C. Motor.
28-in. x 12-ft. Pond.
28-in. x 18-ft. Niles Taper.
32-in. x 17-ft. Pond, T.G.
36-in. x 12-ft Pond, T.G., 220-v., D.C. Motor.
36-in. x 17-ft. Pond Taper, 220-v., D.C. Motor.
36-in. x 20-ft Pond 220-v., D.C. Motor.
36-in. x 28-ft. Bement, T.G.
42-in. x 17-ft. Pond, T.G., 220-v., D.C. Motor.
42-in. x 20-ft. Niles, T.G.
48-in. x 24-ft. Pond Geared Head, 220-v., D.C. Motor.
48-in. x 30-ft. Niles, T.G.
50-in. x 17-ft. Miles (Old Style).
54-in. x 28-ft. American, T.G., 220-v., D.C. Motor.
63-in. x 40-ft. Bement, T.G.

PLANERS AND SHAPERS

20-in. G. & E. Shaper.
20-in. Stockbridge Shaper.
20-in. x 20-in. x 6-ft. Bement.
24-in. x 24-in. x 6-ft. Powell.
24-in. x 24-in. x 6-ft., 8-ft. and 10-ft. Whitcomb B.
26-in. x 26-in. x 6-ft. Gray.
30-in. x 30-in. x 6-ft and 10-ft. Pond, 2 Heads.
30-in. x 30-in. x 6-ft. to 12-ft. Pond, Reversing Motors.
36-in. x 36-in. x 10-ft. to 16-ft. Niles.
36-in. x 36-in. x 12-ft. to 16-ft. Pond, Reversing Motors.
36-in. x 36-in. x 24-ft. Bement.
42-in. x 42-in. x 14-ft. Bement.
42-in. x 42-in. x 26-ft. Pond, Reversing Motor.
48-in. x 48-in. x 16-ft. Pond, Reversing Motor.
48-in. x 48-in. x 20-ft. Bement, Belt.
54-in. x 36-in. x 10-ft. Bement, Belt.
50-in. x 36-in. x 22-ft. Pond, Reversing Motor.
54-in. x 51-in. x 12- to 22-ft. Pond, Rev. motors.
60 in. x 60-in. x 14 ft. to 24 ft. Niles, Belt.
72-in. x 72-in. x 12 ft. Bement, Belt.
72-in. x 60-in. x 14-ft. Bement, Reversing Motor
72-in. x 72-in. x 20-ft. Ridgway, Forge, Reversing Motor.
76-in. x 76-in. x 26-ft. Pond, Reversing Motor.
10-ft. x 10-ft. x 36-ft. Betts, 220-volt, D.C. Motor through belts.

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No. 2-A B & S Universal.
No. 2-B Single Pulley Plain, B. & S.
No. 4 Plain, Cone Pulley, LeBlond.
No. 4 Plain, Cone Pulley, B. & S.
No. 5 Plain, Cone Pulley, B & S.
No. 5 Vertical, Cone Pulley, B. & S.
6 x 48 to 132 in. P. & W., Old Style Thread Millers.
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15-in. Gleason Bevel Gear Generator.
16-in. Cincinnati Gear Hobber (New).
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No. 4—48-in. Newark, 220-volt, D.C. Motor.
No. 55—36-in. Newark Heavy Pinion, 220-volt, D.C. Motor.

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1-Spindle Pierle BB.
32-in. Aurora Tap. Att.
40-in. Aurora Tap. Att.
4-ft. Bickford Speed Box Radial.
5-ft. Niles Full Universal Speed Box.
5-ft. Ridgway, 20-volt, D.C. Motor.
6-ft. Pond, 220-v., D.C. Motor.
6-ft. Niles, Full Universal, Speed Box.
12-Spindle No. 13 P & W Multiple.

BORING MACHINES

36-in.—44-in. Niles Side Head Mill.
51-in. Niles Mill, with Turret Head.
60-in. Bement B & T Mill.
72-in. Ridgway, 220-volt, D.C. Motor.
10-ft. Niles, 220-volt, D.C. Motor.
10-ft.-16-ft. Niles, 220-volt, D.C. Motor.
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6—27-in. x 24-ft. **LeBlond Cone Head High Duty Engine Lathes.**
20—27-in. x 18-ft. **LeBlond Geared Head High Duty Engine Lathes.**
6—30-in. x 12-ft. **American Geared Head Heavy Engine Lathes.**
2—30-in. x 20-ft. **American Geared Head Heavy Engine Lathes.**
3—36-in. x 17-ft. **Putnam Geared Head Heavy Duty Engine Lathes.**
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1—No. 3 24 x 24 x 12 Ingersoll Slab.
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Also 250 Hand and Mfg. Millers.
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MISCELLANEOUS

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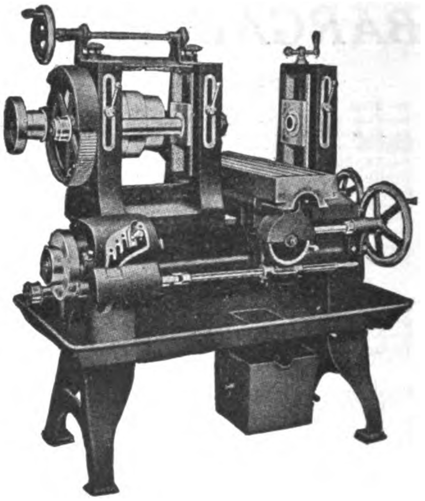

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17 x 17 x 4 ft. Whitcomb Planer.
22 x 22 x 5 ft. Whitcomb.
30 x 30 x 8ft. Whitcomb.
36 x 36 x 12 ft. Gray, 3 heads.
36 x 36 x 13 ft. Betts, 4 heads.
36 x 36 x 22 ft. Pond, 2 heads.
48 x 48 x 16 ft. Patch, 4 heads.

BOLT CUTTERS AND PIPE MACHINES

No. 736 Greenfield Bolt Cutter, 2 in.
3 in. Reliance Bolt Thread and Nut Tapper.
No. 77 Curtis Pipe Machine, 3 in.
No. 96 Curtis Pipe Machine, 6 in.
No. 304-A Oster Pipe Machine, 4 in.

LATHES

10 x 4 Young Bros., foot power.
14 x 6 Rockford.
16 x 8 Reed.
19 x 8 Blaisdell.
21 x 16 Reed.

POWER HAMMERS

40-lb. Bradley Cushioned Helve.
50-lb. Bradley Upright Helve.
300-lb. Beaudry Champion.

PUNCHES AND SHEARS

15 in. throat, No. 17-E New Doty Combination.
36 in. throat, McCabe Combination.
50-in. throat McCabe Combination.

MISCELLANEOUS

No. 00, 0-G, and No. 2 B & S Auttomatic Screw Machines.
No. 4 W & S Type GFH Hand Screw Machines.
2¼ x 24 J & J Flat Turret.
No. 2-B Cochrane & Bly Cold Saw.
No. 1 B & S Grinder with 2 internal grinding spindles.
No. 612 Fellows Gear Shaper.
No. 2 Standard Rotary Swaging Machine.
No. 3½ Langelier Rotary Swaging Machine.
15 in. Kenworthy Non-Oxidizing Annealer.
No. 27½-K Bliss Embossing Press.
No. 9 Manville Knuckle Joint Press.
No. 1 Bliss D. A. Cam Press.
11 x 10 Standard Rolling Mill.
5 x 8 McWilliams Rolling Mill.
48 in. Fay & Eagan Angle Band Saw.
50 lb. Standard Plain Drop.
Type D-1 Syracuse Disc Sander, ½ HP., 220 V., D.C. Motor.
No. 1 Davis Keyseater.
25 HP., G. E., Induction Motor, 550 V., A.C.
No. 1 and No. 2 Garvin Automatic Tapping Machines.

BROWNELL MACHINERY COMPANY
11-13 Eddy St., PROVIDENCE, R. I.

Buy Good Tools From A Reliable House

Boring Mill, 52 in. **Bertram Horiz.**
Boring Mill, 60 in. **Bullard** Vert. 2 hds.
Drill, Radial, 3 ft. **Hilbert**, Pl.
Drill, Radial 60 in. **Hammond** Sens.
Gear Hobber, No. 3 **Adams Farwell**, 2 cutter arbors.
Gear Cutter, No. 3, 26 in. x 10 in. **Cincinnati** Auto.
Grinder, Surface, No. 16 **Blanchard** Vert.
Lathe, 22 in. x 10 ft. **Advance**, Qk. Chg. Gear.
Miller, No. 2 **Cleveland**, Pl. High Power, 16 speed chgs.
Miller, Slab, 20 in. x 30 in. x 8 ft. **Becker-Brainard.**

We'll be glad to send you our August Stock List.

The E. L. Essley Machinery Co.
551-557 Washington Blvd., Chicago, Ill.

LATHES AND PLANERS FOR SALE

4—Springfield Heavy Duty Machine Lathes, motor drive, type 3, size 36 in. x 24 ft., all geared head, power feed in all directions, silent chain drive, follow carriage, tail stock, compound rest steady rest, 4 jaw chuck pressure oil feed with pump and with full set of small equipment; all these machines in excellent condition; will sell cheap.

3—Planers, 36 in. x 10 ft., Woodward & Powell, three graduated heads, two vertical, one horizontal. All power feed, belt driven from countershaft, arranged with motor base, equipped with a set of Newton Centers, head and tail stock, plate; also full set of small equipment; in excellent condition; a great bargain.

Low Price for Quick Sale. Write or Wire.

The S. Snyder Corporation, 14 Mart Place, Rochester, N. Y.

⅝ SHUSTER WIRE AND CUT-OFF MACHINE

12-ft. Maximum Cut-off; in very excellent condition. Price, $500.00 F.O.B. cars here.

LUCAS & SON,
3 Fox St., Bridgeport, Conn.

GRAND RAPIDS SPECIALS

1—9-in. Porter Cable Manufacturing Lathe.
1—9-in. Sunstrand Mfg. Lathe; 1—16-in. Chard Prod. Lathe; 1—16x7 Oliver QCG Lathe.
1—21x10 Schumacher-Boye Std. Lathe.
1—6-spindle Rockford 14-in. Gang Drill.
1—No. 2 Rockford High Power Miller.
1—No. 2 H. Becker Vertical Miller.
1—30x30x8 Pond Planer.

Ask for complete list.

McMULLEN MACHINERY CO.
Grand Rapids, Mich.

WE HAVE A SURPLUS OF LATHES TO SELL

PICK OUT ONE AND SEND 1/3 DEPOSIT

LUCAS WILL NOT DISAPPOINT YOU

2—American and P & W Bench Lathes with equipment	$125
B-4 Dalton Cabinet, legs, draw in, grinding attachment, like new	175
12 x 5 ft. Hendey, rebuilt, taper and draw in	350
14 x 6 ft. Monarch, rebuilt, quick change	350
14 x 6 ft. South Bend, with extra turret, compound rest	225
14 x 7 ft. Hendey, taper attachment, quick change	475
14 x 5 ft. Hendey, taper, draw in, quick change, yoke head, rebuilt	650
16 x 6 ft. Lodge & Shipley motor drive, taper, draw in, geared head, 90% new	850
16 x 8 ft. LeBlond, taper attachment, nice condition	275
2—16 x 6 ft. Reed-Prentice Stud Lathes, each	175
16 x 12 ft. Bradford Lathe, compound and taper	325
16 x 8 ft. Hendey, loose change gears, compound and taper, rebuilt	325
16 x 6 ft. Cisco, quick change	400
18 x 8 ft. Cisco, quick change, collets, excellent shape	475
20 x 8 ft. Cisco, quick change, double back geared	525
18 x 8 ft. Monarch, quick change, raised to 24 in., excellent shape	400
19 x 14 ft. Pond, solid spindle, compound rest	400
20 x 10 ft. Bradford, compound rest, very fine shape	400
24 x 10 ft. Reed, compound rest, nice condition, loose change gears	475
22 x 8 ft. Pratt & Whitney, compound rest	325
26 x 14 ft. Bridgeford, replaned, quick change, 8 ft. C-C compound rest 95% new	1050
26 x 16 ft. Pond Solid spindle 10 ft. C-C compound rest	500
26 x 25 ft. Putnam semi-quick change, compound rest 18 ft C-C	1250
28 x 10 ft. Niles-Bement-Pond quick change double geared rebuilt	750
32 x 24 ft. Pond compound rest 19 ft. C-C	600
40 x 25 ft. New Haven compound rest	850
50 x 16 ft. Pond Lathe face plate drive 8 ft.-6 C-C	1350

As a special inducement will send a fitted chuck with the lathe you want. Don't wait long.

J. L. LUCAS & SON Inc
LUCAS MACHINERY SERVICE
BRIDGEPORT, CONN.

Botwinik Brothers Specials

LATHES

12 x 4, 12 x 5 Hendey, Q.C.G. Engine, taper.
14 x 8 LeBlond Q.C.G. Engine, complete.
16 x 6 Monarch Q.C.G. Engine, complete.
16 x 6 Reed Engine, complete.
16 x 6 South Bend Engine, complete.
26 x 10 Wickes Bros. Q.C.G. Engine, like new.

MILLERS

Brown & Sharpe No. 2 Universal, complete.
Hendey No. 2-G Universal, complete.
Kempsmith No. 1 Plain, Dividing Heads, etc.
Rockford No. 1½ Plain, Dividing Head, etc.
Brown & Sharpe No. 5 Plain, complete.
Ohio No. 3 Vertical, Rotary Tables.
Becker No. 3 Vertical, Rotary Tables.

SHAPERS and PLANERS

16 in. Hendey Friction Shapers.
16 in. Stockbridge, B.G. Crank Shapers.
20 in. Gould & Eberhardt, B.G. Crank Shapers.
20 in. Ohio B.G. Crank Shapers.
24 in. Gould & Eberhardt B.G. Crank Shapers.
24 in. x 24 in. x 6 ft. Gray Sgl. Head Planer.
30 in. x 30 in. x 10 ft. Pratt & Whitney Sgl. Hd.

DRILL PRESSES

Sigourney Sgl. Spindle Sens. Drill Presses.
Barnes 20 in. All-Geared Drill Press.
Excelsior 20 in. B.G., P.F. Drill Presses.
Kokomo 3 Spindle Heavy Sens. Drill Press.
Aurora 28 in. B.G., P.F. Drill Press.
Hammond 3 ft. Sens. Radial Drills.
Niles 6 ft. Universal Radial Drill.
Barnes 20 in., 6 Spindle Gang Drill.

MISCELLANEOUS

V & O No. 101 Reducing Press.
Toledo No. 049 S.S. Power Presses.
Wtbry. Farrel Fdy., long stroke drawing Presses.
LeBlond No. 1 Univ. T. & C. Grinder.
Landis No. 4, 12 in. x 66 in. Plain Cyl. Grinder, complete.
Dwight Slate Power Marking Machine.
Johansson Gauge Blocks, complete set.
Shore Instrument Co., Sclerescope.
Large assortment of small tools, pulleys, hangers, shafting, belting, etc.

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No. 5 Bliss Stiles, wgt. 7300 lb., price $600.
No. 20 Bliss Inclinable, price $275.
No. 19-C Bliss Inclinable, price $250.

BERTOLETTE MACHINE TOOL CO
357 West Side Ave., Jersey City, N. J.

FRANK TOOMEY, Inc.

127-131 N. THIRD ST. PHILADEPHIA, PA.

MACHINE TOOLS

LATHES

9-in. x 36-in. Johnston, Bench, New.
13-in., 14-in. and 16-in. Carroll-Jamieson, New.
10-in. to 36-in. Sidney, New.
13-in. x 5 ft. 6 in., Carroll-Jamieson, Used.
13-in. x 7-ft., Willard, Used.
16-in. x 8-ft., Monarch, Q.C., Used.
17-in. x 8-ft., Sidney, Q.C., Used.
19-in. x 8-ft., LeBlond, Q.C., Used.
19-in. x 10-ft., Sidney, Q.C., Used.
20-in. x 8-ft., Whitcomb, Q.C., Used.
24-in. x 12-ft., Sellers, P.C.G., Used.

TURRET LATHES

No. 1 and No. 6 Bardons & Oliver, W.F., Used.
2¼-in., Mult. Spindle Gridley Aut., Used.
No. 6 Warner & Swasey, W.F. and Chuck, Used.
No. 12½ Garvin, W.F., Used.
21-in. Gisholt, 2⅛ in. cap., Used.
26-in. Davis, Chuck Outfit, Used.

DRILLING MACHINES

36-in. Hamilton Plain, T.A., New.
42-in., Martin, Plain, G.B., New.
36-in., Aurora, Sliding Head, Used.
32-in., Superior Sliding Head, New.
28-in., Superior, Sliding Head, New.
25-in., Superior, Sliding Head, Used.
25-in., Buffalo, Stationary Head, New.
28-in., Rockford, Sliding Head, Used.
26-in., Rockford, Sliding Head, Used.
23-in., Rockford, Sliding Head, Used.
20-in., Champion & Excelsior, New.
14-in. and 10-in., Excelsior, New.
20-in., Aurora, B.G., P.F., Used.

PLANERS

36-in. x 36-in. x 14-ft., Ohio, 4 heads, Used.
36-in. x 36-in. x 10-ft., Cincinnati, 3 heads, mtr., Used.
24-in. x 24-in. x 8-ft., Hendey, 1 head, Used.
24-in. x 24-in. x 6-ft., Pease, 1 head, Used.
36-in. x 36-in. x 8-ft., Gray, 2 heads, Used.

SHAPERS

16-in. to 24-in., Steptoe, New.
20-in., Cincinnati, B.G., Used.
20-in., Smith & Mills, B.G., Used.

MILLERS

No. 1 Dow, Plain, New.
No. 2 Cincinnati, Universal, Used.
No. 3 Cincinnati, Plain, Used.
No. 2-B Milwaukee, Plain, Used.
No. 1½ American, Plain, New.
No. 0 Steptoe, Hand, New.
No. 3 Burke, Hand, New and Used.

GRINDERS

Norton, 10 x 30 in., Plain, Used.
Modern, 8 x 30 in., Plain, Used.
Fraser, 8 x 20 in., Universal, New.

BORING MILLS

42-in., Bullard, 2 heads, Used.
3-in., Bar Binnse, hor., Used.

MISCELLANEOUS

Bolt Cutters, Greenfield, 1½ in. and 2 in., New.
Hack Saws, Peerless & North Wales, New.
Hack Saws, No. 4 Marvel, Used.
Hack Saws, Kwik-Kut, 8 in., Used.
Hammers, 100 lbs., Little Giant, New.
Keyseaters, No. 2 and No. 4, Catlin, Used.
Pipe Machines, 2 in., 4 in., 6 in., Oster, New.
Presses, Watson & Stillman, 30 T. Hyd., Used.
Shears, Gray No. 1, Cap. 3/16-in. sheets, Used.
Slotters, 10-12-in. Drill, Used.

TOOLS FOR IMMEDIATE SHIPMENT

Air Compressors, Chicago Pneu., 9 x 8 and 12 x 10
Die Heads, Namco, ½ to 2 in., self-opening.
Drills, Henry & Wright, 1 and 2 spindle, high speed
Drills, 20-in., new, special price $111.50 each.
Grinder, 10 x 24 in. Norton, plain.
Inclinable Press, Robinson O. B., No. 1½ in.
Lathe, Barnes, 9 in., comp. rest, hollow spindle
Lathe, LeBlond, 13 in. x 5 ft., collet attachment
Miller, Bilton, No. 25, plain
Miller, Briggs, Type "A"
Motors, G. E., ½ to 50 hp., 3-phase.
Oil Groover, Garvin, new
Oil Separator, Springfield
Pipe Machines, 2, 4, 6 and 12 in.
Planer, Pond, 44 x 44 in. x 12 ft. 4 hd.
Plate Grinders, Yates, 36 and 66 in.
Radial, Morris, 3 ft., plain, cone drive
Shaper, Steptoe, 16 in.
Torches, welding and cutting
Turret Lathe, Tilted, 1½ in., power feed
Universal Grinder, W. & P., 10 x 30 in.

THE OSBORNE & SEXTON MACHINERY CO.
Columbus, Ohio
Branch—Dayton, Ohio., 1118 Lindsey Bldg. Z

13 in. x 6 ft. Champion Tool Wks. Lathe.
18 in. x 7 ft. Oliver Lathe, Q.C.G.
18 in x 9 ft. Lehman Lathe, Q.C.G..
18 in. x 6 ft. Lodge & Shipley Geared Head.
20 in. x 10 ft. Reed Lathe, pan bed.
18 in. Prentice Turret Lathe.
1½ in. Acme Screw Machine, F.B.G., Power Feed.
2½ ft.. Cin. Bickford Radial.
No. 310 Baker Drill, 2½ in.
26 in. Prentice, all geared upright Drill.
36 in. Prentice Drill, tapping attachment.
24 in. Barnes Drill with tapping chuck.
Five Spindle Detroit Hor. Driller.
24 in. and 36 in. Powell High Speed Planers.
38 in. x 38 in. x 20 ft. Pond Planer, 2 heads.
72 in. x 72 in. x 26 ft. Niles Planer, 4 heads.
No. 32 Kempsmith Lincoln Miller.
2—12 in. Leland-Gifford Sens. Drills.
3—No. 15 Garvin Plain Millers.
No. 330 Fay-Egan Variety Saw Table, with mortising attachment.

HARRY F. ALLEN
30 Church St., New York

WAR DEPARTMENT

OCTOBER

Oct. 10—Q.M. SUPPLIES—Camp Grant, Ill., Auction. For catalog write Q.M.S.O., 1819 W. Pershing Road, Chicago, Ill.

Oct. 10—MEDICAL SUPPLIES—New York City, Auction. For catalog write Surplus Property Sect., Office, Surgeon General Washington, D. C.

Oct. 11—AIR SERVICE SUPPLIES—Carlstrom Field, Fla., Auction. For catalog, write Commanding Officer, Carlstrom Field, Fla.

Oct. 17—Q. M. SUPPLIES—Camp Dix, N. J., Auction. For catalog write Q.M.S.O., 1st Ave. & 59th St., Brooklyn, N. Y.

Oct. 19—POWER HOUSE EQUIPMENT—Rock Island, Ill., Sealed Bids. For catalog, write C. O., Rock Island Arsenal, Rock Island, Ill.

Oct. 24—AIR SERVICE EQUIPMENT—Montgomery, Ala., Auction. For catalog write C. O., Air Reserve Depot, Montgomery, Ala.

Oct. 24—FLOATING EQUIPMENT—Port Newark, N. J., Auction. For catalog write Q.M.S.O., 1st. Ave. & 59th St., Brooklyn, N. Y.

Oct. 27—MEDICAL SUPPLIES—Washington, D. C., Auction. For catalog write Surplus Property Sect., Office, Surgeon General, Washington, D. C.

Oct. 30—AIR SERVICE EQUIPMENT—Richmond, Va., Auction. For catalog write C. O., Air Reserve Depot, Richmond, Va.

SEND FOR CATALOG

WAR DEP

SELLING PROGRAM

NOVEMBER

Nov. 10—Q. M. SUPPLIES—Schenectady, N. Y., Auction. For catalog write Q.M.S.O., 1st Ave. & 59th St., Brooklyn, N. Y.

Nov. 14—Q. M. SUPPLIES—Camp Lewis, Wash., Auction. For catalog write Q.M.S.O., Ft. Mason, San Francisco, Calif.

Nov. 14—AIR SERVICE EQUIPMENT—Long Island, N. Y., Auction. For catalog write C. O., Air Service Depot, Long Island, N. Y.

Nov. 15—Q. M. SUPPLIES—Brooklyn, N. Y., Auction. For catalog write Q.M.S.O., 1st Ave. & 59th St., Brooklyn, N. Y.

Nov. 16—MEDICAL SUPPLIES—Philadelphia, Pa., Auction. For catalog write Surplus Property Sect., Office, Surgeon General, Washington, D. C.

Nov. 21—Q. M. SUPPLIES—Camp Knox, Ky., Auction. For catalog write Q.M.S.O., 1819 W. Pershing Road, Chicago, Ill.

Nov. 23—Q. M. SUPPLIES—Chicago, Ill., Auction. For catalog write Q.M.S.O., 1819 W. Pershing Road, Chicago, Ill.

Nov. 28—Q. M. SUPPLIES—New Orleans, La., Auction. For catalog write C. O., Q. M. Surplus Property Depot, Atlanta, Ga.

DECEMBER

Dec. 5—Q. M. SUPPLIES—San Antonio, Tex., Auction. For catalog write Q.M.S.O., Ft. San Houston, San Antonio, Texas.

Dec. 12—Q. M. SUPPLIES—Columbus, Ohio., Auction. For catalog write, Q.M.S.O., 1819 W. Pershing Rd., Chicago, Ill.

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Men Have Slaved Years To Make *What One of these ads will save you*

YOUR favorite paper or business publication will tell you more about how to pay dividends than all the stock selling literature in the world.

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FOR SALE

AIR COMPRESSOR

Ingersoll-Rand, Class ER-1, 12 in. x 6 in. with unloader, piping and 2 tanks, 274 cu. ft., 9 lb. pressure. This equipment is in good running order. Price $500.00.

TAYLOR MFG. CO., INC.,
10 Portland St., Cambridge, Mass.

SPOT AND BUTT ELECTRIC WELDERS
Bought and Sold

I am specializing in Used Spot and Butt Electric Welding Machines. Tell me your needs and I may have a Used Machine that is good as new that I can furnish you at a big saving. Or if you have any Electric Welding Machines that you have no further use for, I will buy them.

M-861, American Machinist
10th Ave. at 36th St., New York City

WANTED

MILLING MACHINE

Second-hand Warner & Swasey, 2 spindle, valve, for milling the Hex on valve bonnets.

W-856, American Machinist,
1570 Old Colony Bldg., Chicago, Ill.

WANTED

36 in. Vertical Boring Mill

Must be modern and up-to-date tool in first class condition. Preferably with two heads and single pulley drive.

W-879, American Machinist
10th Ave. at 36th St., New York City.

WANTED

AIR COMPRESSOR

Belt driven, double action single cylinder. 100 cubic feet free air per minute, at 75 lbs. pressure. Give full details; age, condition, price and if guaranteed.

BRASS GOODS MFG. CO.
No. 345 Eldert St., Brooklyn, N. Y.

NEW LATHES

At Special Price

2—New Le Blond 27 in. x 24 ft. Lathes, 3-step cone, double back geared, quick change gears, swing over ways 30-in. Turret tool post, oil pan, double friction countershaft with belt shifter and power feed boring bar head included in regular equipment.

Price, F.O.B. Chicago, $1900 each

Write for Further Information

FS-810, American Machinist
1570 Old Colony Bldg., Chicago, Ill.

ALL BARGAINS

POND Planer, 38 in. x 60 in. x 9 ft., with 2 hds.
DETRICK & HARVEY Floor type Boring Mill.
McCABE "2 in 1" Lathe, 48 in.—26 in. swing. 16 ft. bed. (Takes 10 ft. between centers.)
KEMPSMITH No. 3 Plain Milling Machine.
BATH No. 2 Universal Grinder with "C" equipt.
PRENTICE BROS. Drill Press, P.F., B.G., etc.
Many other bargains. Send for list.

F. JOS. LAMB CO., Detroit, Mich.

2—Beaman and Smith Continuous Millers

1—18 in. x 16 in. and 1—26 in. x 20 in. For cylinders, crank cases, etc.

MILES MACHINERY CO.,
Saginaw, Mich.

LARGE STOCK OF NEW
H. S. MILLING CUTTERS, SLITTING & SCREW SLOTTING SAWS, ENDMILLS, COUNTERBORES, COLLETS, REAMERS.

Half Price or less. Send for Complete List.

PAUL FROILAND
Leyfred Terrace, Springfield, Mass.

MILLING MACHINES

Plain and Universal

NEW

6—P. & W. 12-in. Auto. Mills.
3—No. 1½ Rockford Univ., cone type, 25x7½ x18.
2—No. 2½ Rockford Univ., cone type, 34x9x18.
1—No. 2½ Rockford Univ. high power geared, single, pulley drive; cap. 34 x 9 x 18.
1—No. 1½ American Univ., cone type, 25x9x18.
1—No. 1½ American Plain, cone type, 25x9x19.
1—No. 0 Bickett Vert. Miller and Profiler.

USED

1—No. 1 Cincinnati Plain; arranged motor drive.
1—No. 1½ American Plain, cone type.
1—No. 2 Becker Plain; arranged motor drive.
1—No. 4 Cincinnati Univ., arranged motor drive.
6—No. 32 Kempsmith, Lincoln type, 36 x 12.
1—Ingersoll Slab, 20 x 20 x 8 ft.
1—No. 1 Newton Keyseat Miller; arranged M. D.
1—No. 2 Newton Keyseat Miller, arranged M. D.

A FEW MISCELLANEOUS SELECTIONS

3—16 in. x 8 ft. Sidney Lathes; Q. C., D. B. G.
1—37 in. Niles Boring Mill, 2 heads.
1—50 in. Sellers Car Wheel Borer.
1—52 in. Bertsch Multiple Punch.
3—Quickwork Rotary Shears; cap. up to 1 in.
2—Thompson Univ. Grinders, 10 x 36 in.
12—Gisholts 21 in. and 24 in. Turret Lathes.
14—Screw Machines; ½ to 3¼ in. cap.
4—Radial Drills; 3½, 4 and 5 ft. plain and univ.
3—No. 2 Oakley Univ. Cutter and Tool Grinders.
1—No. 20 Lea Simplex Metal Saw.

We have over 1,000 machines in stock. Send us your inquiries. Our Guarantee: Money back if not satisfied.

Wayne Machinery Co., Ft. Wayne, Ind.

NEW CHUCKS

Universal Geared Scroll

Made by Gisholt Machine Co.

50% off List Price

Improved Standard Pattern, particularly high class and heavy construction. Chuck bodies are of close grained Cast Iron.

Sizes and Prices:

7½ in.	$16.00
9 in.	19.00
10½ in.	22.00
12 in.	26.00

F. O. B. Cars, New York

Walter Silber, *Agent*
109 South 5th Street, Brooklyn, N. Y.

POSITIONS VACANT

EMPLOYMENT

POSITIONS WANTED

POSITIONS VACANT

Connecticut

FOREMAN for a machine shop wanted. Must be an executive, able to keep men busy, and get out the work right. Must have a knowledge of machine tools, including grinding machinery and presses. A permanent position for the right man. Address reply, stating past experience, present place of employment, and wages expected. P-866, Am. Mach.

New York

WANTED—A first class blacksmith on heavy machine forgings such as crank shafts, dies, etc., in manufacturing concern. Applicants must state age, full experience and references. Address replies to Box 377, Waterbury, Conn.

WANTED—First class blacksmith to take charge of blacksmith shop employing ten men in manufacturing plant, one with experience on machine forgings preferred. Applicants must state age, full experience and references. Address replies to Box 377, Waterbury, Conn.

New Jersey

EXPERIENCED man wanted to take charge of automatic screw machine department, also experienced man for punch press department. In reply state experience, age and salary desired; good opportunity for capable men; location New Jersey. P-883, Am. Mach.

TWO experienced hot galvanizers and two electroplaters; steady work. State experience and wages desired. P-884, Am. Mach.

POSITIONS VACANT

Pennsylvania

FOREMAN for machine department of large concern building heavy machinery. State age, experience and salary expected. P-872, Am. Mach., Leader-News Bldg., Cleveland, O.

West Virginia

POSITION open for master mechanic with ability to design production tools for automatic screw machines, etc., and capable of general plant engineering. Only applicants of approved ability considered. State salary expected and experience with references in first letter. P-865, Am. Mach., Leader-News Bldg., Cleveland, Ohio.

EMPLOYMENT AGENCIES

GENERAL ENGINEERING AGENCY, Pittsburgh. Serving employers everywhere, overnight proposals, gratis, require Works Managers, Superintendents, Chief Draftsmen, Designers, Plant Engineers, Master Mechanics, Tool Draftsmen, Salesmen, Foundry, Forge, Machine Shops, General Office.

LARGE MANUFACTURER

Now building for leading railroads an important and successful locomotive auxiliary device, solicits applications from men with locomotive shop experience for field service organization. Technical knowledge advantageous, but not absolutely necessary. Tact, mechanical ability and resourcefulness of prime importance. Submit full particulars of experience, stating height, weight and include, if possible, small photograph.

P-878, American Machinist,
10th Ave. at 36th St., New York City

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A LEADING organization desiring to fill an important position, for obvious ethical and other reasons, cannot invite directly the candidacy of any particular man. Similarly, no well-connected man will exploit personally his own qualifications, no matter how receptive he may be to overtures. The undersigned has been retained by a national clientele for many years, as a medium for negotiating preliminaries in such cases. Your permission to send booklet discussing this problem and describing the service, will in no degree obligate or compromise you. Strictly confidential. R. W. Bixby, Inc., 307 Lockwood Bldg., Buffalo, N. Y.

POSITIONS WANTED

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FOREMAN screw machines by American, thirty-three years of age; four years' experience as general machinist, ten years setter-up and foreman of automatics and hand screws; thoroughly familiar with feeds, speeds and tooling on all classes of screw products, also familiar with piece-work and bonus systems. PW-858, Am. Mach., Old Colony Bldg., Chicago, Ill.

Massachusetts

DESIGNING engineer and production executive. Long experience in charge of tooling for quantity production of interchangeable parts, with prominent concerns. PW-839, Am. Mach.

POSITIONS WANTED

Kansas

GEAR hobbing. Machine designer, American; twenty-five years' experience, twelve on hobbing machines, two of which are of well-known make. Several patents on this class of machinery have been assigned by me. Would like to connect with responsible concern wishing to develope full line of machines for Spur and Spiral, Worm-Gear and Bevel-Gear hobbing; new designs, powerful machines, quantity producers; straight salary or salary and bonus; report for work about Dec. 1. Address F. H. Greenwood, Box 74, Lebanon, Kan.

New Jersey

MAINTENANCE engineer; twelve years' practical experience in construction operation and maintenance. Established executive ability and reputation for getting results Expert in metal working, machine shop practice, welding, etc. Qualified for position as mechanical superintendent or master mechanic. PW-876, Am. Mach.

MECHANICAL executive 20 years' experience, 12 years foreman and general foreman, good organizer well experienced in up to date manufacturing methods, capable of handling help and get results. PW-869, Am. Mach.

PRODUCTION manager or superintendent, twenty years' experience, twelve as manager, eight as production and plant engineer, thoroughly acquainted with sheet metal and wire working machinery, inventive, supervise, design, tools and machinery; go anywhere. PW-840, Am.Mach.

New York

DESIGNER, machine and tools; twelve years' shop and technical experience; prefer New York City or vicinity. PW-854, Am. Mach.

EXECUTIVE, thirty-five, having eighteen years' experience in manufacturing, held position as superintendent, desires to connect with growing concern; location immaterial. PW-882, Am. Mach.

IF you wish to reduce your production costs address PW-886, Am. Mach. Not a systematizer, but a practical shop man who can show results from past performance.

MACHINE designer specializing in motion picture projectors, automatic paper cup machinery, special machinery for valves and fittings; executive and machine shop experience. PW-889, Am. Mach.

PATTERN shop foreman, forty; twenty years' general experience machine tools, heavy oil engines, valves and fittings, etc.; last three years as foreman; thorough knowledge of foundry practice; first class references. PW-888, Am. Mach.

PRODUCTION man, thoroughly competent and experienced in production methods, systematizing, planning and rate setting, as production head or assistant to manager, or will install piece-work or premium system; highest references. PW-881, Am. Mach.

SALES engineer desires position; sixteen years' experience drafting, engineering and selling; pumps, steam turbines and power plant equipment; age thirty-five, married. PW-880, Am. Mach.

SUPERINTENDENT, production engineer or works manager, thirty-five, ideal experience, best education, good personality. PW-871, Am. Mach.

Michigan

PRODUCTION manager or superintendent, practical mechanic with long successful experience as executive in charge of plant operations and the economical production of duplicate parts in quantity. Experienced in handling tool design, cost systems and time study. Location immaterial. PW-873, Am. Mach., Leader-News Bldg., Cleveland, O.

POSITIONS WANTED

Pennsylvania

FACTORY manager or superintendent, 20 years' successful experience handling help and training foreman familiar with modern methods of manufacturing duplicate and interchangeable parts, setting of piece work prices for hand screw machine punch press and automatic screw machine work. Production my specialty. Age 39; at present holding responsible position, salary $4,000; looking for a city with good schools. A live wire man who can find factory leaks. First class references. PW-857, Am. Mach., Real Estate Trust Bldg., Phila., Pa.

TOOL designer, first-class, wide experience on special automatic machinery, jigs, fixtures and tools, desires position; American, good executive, with thorough shop training. PW-838, Am. Machinist, Real Estate Trust Bldg., Phila., Pa.

Tennessee

A MAN with sixteen years of shop and technical experience from apprenticeship to mechanical engineering and superintendent inclusive, desires location as master mechanic, mechanical engineer, or as superintendent, or assistant to either, with foundry and machine shop or manufacturing plant. At present temporary employed. PW-863, Am. Mach., Old Colony Bldg., Chicago, Ill.

Wisconsin

POSITION as Factory Manager, General Superintendent or Industrial Engineer wanted by technically educated mechanical engineer. Eighteen years' experience in engineering and manufacturing in both metal and wood. Energetic, tactful and thorough. Best of references. Location optional. PW-829, Am. Mach.

EXTRA WORK WANTED

DESIGNER on jigs, fixtures and small machines would like evening work; can spare twenty hours a week. EWW-853, Am. Mach.

AGENTS AND SALESMEN

Energetic Salesman

For New England to represent large manufacturer of twist drills. Only strictly high-grade man with best of reference considered. AS-867, Am. Mach.

Salesman Wanted

Salesmen calling upon grinding machine users can make a very attractive supplemental income selling diamond-pointed tools made by an entirely new process which overcomes all the weaknesses of the familiar casting and brazing processes. Liberal commissions enable hustlers with the right connections to earn $50 a week and up. All replies will be treated in strictest confidence. AS-885, Am. Mach.

REPRESENTATION WANTED

To Dealer, Jobber and Consumer

Everywhere to sell Helical Flute Expansion Reamer. (Patent protection.) Commission will net $300.00 to $1,000.00 monthly. Write for complete details. Millersburg Reamer & Tool Co., Inc., Millersburg, Pa., U. S. A.

PATENT ATTORNEYS

PATENTS, C. L. Parker, patent attorney, McGill Bldg., Washington, D. C. Inventor's handbook sent upon request.

PATENTS—Send for form "Evidence of Conception" to be signed and witnessed. Form fee schedule, information, free. Lancaster and Allwine, 262 Ouray Bldg., Washington, D. C.

BUSINESS OPPORTUNITIES

Product Wanted

Well established company with ample finances and modern plant will consider acquiring outright or on royalty basis an additional product of proven merit; must be in nature of medium weight machinery, tools or equipment. BO-887, Am. Mach., Old Colony Bldg., Chicago, Ill.

Mechanical Executive

Who is acquainted with the die-casting business and who can organize and lead sales organization for such will be offered real opportunity with good going corporation; must be willing to invest $12,000, which will be fully secured. Only gentleman who is familiar with methods of obtaining business in this line should reply. BO-842, Am. Mach.

MISCELLANEOUS

Standards Sheets

Draftsmen, toolmakers and diemakers, our standards sheets will help you to perform your work more efficiently. Write and ask us to send details. Standards Engineering Co., 2030 Palmetto St., Brooklyn, N. Y.

FOR SALE

Johanson Gage Blocks

Brand new, set No. 1 and standard accessories; price $650. Armore, Box 1518, New Haven, Conn.

U. S. GOVERNMENT

SEALED PROPOSALS will be opened by the Supt. of Lighthouses, Room 340, P. O. Bldg., Detroit, Mich., 2 p.m., October 10, 1922, for furnishing one 27-in. Lathe and one 24-in. Shaper, both individual motor driven. Information upon application.

Notice to Advertisers

Owing to the Holiday—Columbus Day, Thursday, October 12th — the *"Searchlight"* pages of the October 19th issue of *American Machinist* will close for press earlier than usual. Copy should reach us as follows:

DISPLAY ADS.—Copy required by 10 A. M., Wednesday, October 11th.

WANT ADS—Copy required by 10 A. M., Friday, October 13th.

Contract Work

We Can Build Your Special Machinery
And Build it Right

Our equipment is of the best.
Our prices will be fair.

Send us your specifications for our estimate

The Kempsmith Mfg. Co.

Milwaukee, U. S. A.

SPECIAL MACHINERY
BUILT TO ORDER

We have splendid facilities for producing special machinery of all kinds, and are prepared to guarantee satisfaction—both as regards workmanship and price. We have foundry facilities and an up-to-date machine shop. Send us blue-prints and give us an opportunity to quote you price. We can save you money.

Lambert & Todd Machine Co., Camden, N. J.

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of all kinds
manufactured in
small or large
quantities.

Send sample or blueprint

East End Machine Works
408 Elderado St., Appleton, Wis.

GREY IRON, BRASS

CASTINGS

In Quantities
HOT GALVANIZING
GILBERT & BARKER MFG. CO.
Springfield (Dept. 21) Mass.

CASTINGS

BRASS, BRONZE AND ALUMINUM
MACHINE WORK.

THE COLUMBUS BRASS COMPANY
540 DUBLIN AVE., COLUMBUS, OHIO

MACHINE WORK WANTED

FRANKLIN MACHINE CO.
Engineers, Founders and Machinists
Providence, R. I.

Textile machinery, heavy machinery, special machinery of all kinds.

The Harris-Corliss Steam Engines.

Eastern Representative for Cleveland Worm Gears and Worm Gear Reduction Units

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WE SPECIALIZE IN THE DESIGN AND MANUFACTURE OF

Jigs—Fixtures—Ring, Plug and Snap Gauges—Special Machines — Blanking — Piercing—Drawing—Forming and Sub Press Die Work

Send Blueprints for Estimates

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TRADE MEHL MADE MARK

HIGH-GRADE

Jigs, Fixtures, Dies, Gauges and Special Machines

Send for free illustrated prospectus

MEHL MACHINE TOOL & DIE CO.
ROSELLE, N. J.
Established 1913

Thirty Minutes from New York City

Special Machinery and Machining of Parts

A modern factory with new Machine Tools, Heat-Treating Department, Tool Room and Pattern Shop, Foundry and Forging Service. Complete facilities from engineering to shipping. An experienced organization, manufacturers of high-grade turret lathes, is ready to assume your manufacturing problems, from machining parts to designing and building complete machines.

Quality work by modern methods.

Millholland Machine Company
1106 West Twenty-Third St.
Indianapolis, Indiana

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Contract Work

ANY TO LET?

JIGS TOOLS DIES

Special Reamers and Arbors, Boring Bars, Spot Facing Tools, Gauges, Forming Tools, Stampings. Mail your inquiries for Tools, Dies, Jigs, Fixtures, Stampings to
AMERICAN TOOL & MFG. CO.
Urbana, Ohio
A Card will bring our Catalogue

WHAT AND WHERE TO BUY

A Classified Index of Advertisers in This Issue

For Alphabetical Index See Last Page

Abrasive Discs
Badger Tool Co., Beloit
Besly & Co., Charles H., Chicago
Carborundum Co., Niagara Falls
Gardner Mch. Co., Beloit

Abrasive Materials
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Dickinson, Thomas L., N. Y.
Gardner Mch. Co., Beloit
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield

Accumulators, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson- Stillman Co., N. Y.

Aftercoolers, Air
Chicago Pneumatic Tool Co., N. Y.

Air Lifts
Sullivan Mchy. Co., Chicago

Air Operated Countershafts
Hannifin Mfg. Co., Chicago

Air Operated Mandrels
Hannifin Mfg. Co., Chicago

Air Operated Vises
Hannifin Mfg. Co., Chicago

Air Receivers
Chicago Pneumatic Tool Co., N. Y.

Angle Plates
Boston Scale & Mach. Co., Boston

Arbors
Bath & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cochrane-Bly Co., Rochester
Cushman Chuck Co., Hartford
National Twist D. & T. Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre
Standard Eng. Wks., Pawtucket
Union Mfg. Co., New Britain
Union Twist Drill Co., Athol
Whitman & Barnes Co., Akron
Whitney Mfg. Co., Hartford

Balancing Ways
Anderson Bros. Mfg. Co., Rockford

Ball Retainers
Bearings Co. of America, Lancaster

Balls, Brass, Bronze and Steel
Abbott Ball Co., Hartford
Auburn Ball Bearing Co., Rochester
Strom Steel Ball Co., Oak Park

Barrels, Tumbling
Abbott Ball Co., Hartford
Globe Mch. & Stamp Co., Cleveland
Royersford F. & M. Co., Royersford

Bars, Boring
Davis Boring Tool Co., St. Louis
Gisholt Mach. Co., Madison
Hannifin Mfg. Co., Chicago
Marvin & Casler Co., Canastota
Underwood Corp., H. B., Philadelphia

Bars, Boring Expansion
Davis Boring Tool Co., St. Louis

Bars, Bronze Cored
Bunting Brass & Bronze Co., Toledo.

Bearings, Ball
Aetna Ball Bear. Mfg. Co., Chicago
Auburn Ball Bearing Co., Rochester
Bearings Co. of America, Lancaster
Boston Gear Wks., Quincy
Fafnir Bearing Co., New Britain
Norma Co. of America, N. Y.
Schatz Mfg. Co., Poughkeepsie
U. S. Ball Bearing Co., Chicago

Bearings, Bronze
Bunting Brass & Bronze Co., Toledo
Doehler Die Casting Co., Brooklyn

Bearings, Die-Cast
Doehler Die Cast. Co., Brooklyn
Franklin Die Cast. Corp., Syracuse
Light Mfg. & Fdry. Co., Pottstown.

Bearings, Journal
Bunting Brass & Bronze Co., Toledo
Columbus Brass Co., Columbus

Bearings, Roller
Norma Co. of America, N. Y.
Royersford F. & M. Co., Royersford

Belt Cement
Schieren Co., Chas. A., N. Y.

Belt Clamps
Hoggson & Pettis Mfg. Co., New Haven

Belt Dressings and Fillers
Schieren Co., Chas. A., N. Y.
Texas Co., N. Y.
White & Bagley Co., Worcester

Belt Fasteners
Bristol Co., Waterbury

Belt Lacing
Schieren Co., Chas. A., N. Y.

Belt Lacing Machines
Birdsboro Steel F. & M. Co., Birdsboro

Belt Shifters
LeBlond Mch. T. Co., R. K., Cincinnati

Belt Tighteners
Jones Fdry. & Mch. Co., W. A., Chicago

Belting, Chain
Link-Belt Co., Chicago, Philadelphia
Morse Chain Co., Ithaca
Whitney Mfg. Co., Hartford

Belting, Endless
Brown Mfg. Co., Arthur S., Nashua

Belting, Leather
Schieren Co., Chas. A. N. Y.

Bench Legs
Brown & Sharpe Mfg. Co., Providence
Manufacturing Equip. & Eng. Co., Framingham

Benches, Work
Manufacturing Equip. & Eng. Co., Framingham
Western T. & Mfg. Co., Springfield. O.

Bending Machines, Power
Long & Allstatter Co., Hamilton
Ryerson & Son, Jos. T., Chicago

Blocks, Chain (See Hoists, Hand)

Blocks, Pillow
Jones Fdry. & Mch. Co., W. A., Chicago

Blowers
Buffalo Forge Co., Buffalo
Chicago Flexible Shaft Co., Chicago
General Electric Co., Schenectady

Blue Print Paper
N. Y. Blue Print Paper Co., N. Y.

Blue Printing Lamps
Cooper-Hewitt Elec. Co., Hoboken

Blue Printing Machinery
N. Y. Blue Print Paper Co., N. Y.

Bolt and Nut Machinery
Acme Mchy. Co., Cleveland
Anderson Die Mch. Co., Bridgeport
Foote-Burt Co., Cleveland
Landis Mach. Co., Waynesboro
National Machy. Co., Tiffin.
Greenfield Tap & Die Corp., Greenfield
Pawtucket Mfg. Co., Pawtucket
Universal Mch. Co., Bowling Green
Victor Tool Co., Waynesboro

Bolts and Nuts
Hartford Mch. Screw Co., Hartford
National Acme Co., Cleveland

Bone for Case Hardening
Rogers & Hubbard Co., Middletown

Books, Technical
McGraw-Hill Book Co., N. Y.

Boosters
General Electric Co., Schenectady

Boring & Turning Mills, Horizontal
Gisholt Machine Co., Madison

Boring and Turning Mills, Vertical
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Bickford & Co., H., Lakeport
Bullard Mch. Tool Co., Bridgeport
Cincinnati Planer Co., Cincinnati
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Sellers & Co., Wm., Philadelphia

Boring, Drilling and Milling Machines, Horizontal
Barnes Co., W. F. & John, Rockford
Bausch Mch. T. Co., Springfield, Mass.
Beaman & Smith Co., Providence
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Gisholt Mach. Co., Madison
Landis Tool Co., Waynesboro
Lucas Machine Tool Co., Cleveland
Moline Tool Co., Moline
Murchey Mch. & Tool Co., Detroit
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Pawling & Harnishfeger Co., Milwaukee
Sellers & Co., Wm., Philadelphia
Springfield Mch. T. Co., Springfield, O.
Vandyck Churchill Co., N. Y.

Boring, Drilling and Milling Mach., Vertical
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Knight Mchy. Co., W. B., St. Louis
Pawling & Harnischfeger Co., Milwaukee
Rockford (Ill.) Drilling Mach. Co.

Boring Heads
Davis Boring Tool Co., St. Louis
Lovejoy Tool Co., Springfield, Vt.
Marvin & Casler Co., Canastota

Boring Tools
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
Davis Boring Tool Co., St. Louis
Hannifin Mfg. Co., Chicago
Lovejoy Tool Co., Springfield, Vt.
Western T. & Mfg. Co., Springfield, O.
Williams & Co., J. H., Brooklyn

Boxes, Tote (See Furniture, Machine Shop)

Brackets, Lamp Adjustable
McCrosky Tool Corp., Meadville

Broaches
Hurlbut Rogers Broach Co., Hudson
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson,
Paramount Spec. T. Co., Waltham

Broaching Machines
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson,
Pawtucket Mfg. Co., Pawtucket

Bronze
Bunting Brass & Bronze Co., Toledo

Bronze, Phosphor
Bunting Brass & Bronze Co., Toledo

Bucket Carriers, Pivoted
Link-Belt Co., Chicago, Philadelphia

Buffing or Polishing Machines (See Polishing and Buffing Machines)

Bulldozers
Long & Allstatter Co., Hamilton

Burners, Oil and Gas
Advance Furnace & Eng. Co., Springfield, Mass.
Best Furnace & Burner Co., W. N., N. Y.
Johnson Gas Appliance Co., Cedar Rapids.

Bushings
Bunting Brass & Bronze Co., Toledo
Columbus Brass Co., Columbus

Cabinets, Tool
Armstrong Bros. Tool Co., Chicago

Calipers
Athol Mach. & Fdry. Co., Athol
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol

Cam Cutting Machines
Garvin Mach. Co., N. Y.
Rowbottom Mach. Co., Waterbury
Walcott Lathe Co., Jackson

Cameras
Photostat Corp., Rochester

Cams
Rowbottom Mach. Co., Waterbury

Can-Making Machinery (See Sheet Metal Working Machinery)

Carbonizing Machines
American Gas Furnace Co., Elizabeth

Castings, Aluminum
Bunting Brass & Bronze Co., Toledo
Doehler Die Casting Co., Brooklyn
Light Mfg. & Fdry. Co., Pottstown

Castings, Brass and Bronze
Accurate Brass Casting Co., Brooklyn
Bunting Brass & Bronze Co., Toledo
Columbus Brass Co., Columbus
Doehler Die Cast. Co., Brooklyn
Du Pont Eng. Co., Wilmington
Gilbert & Barker Mfg. Co., Springfield, Mass.
Imperial Brass Mfg. Co., Chicago
Light Mfg. & Fdry. Co., Pottstown

Castings, Die Molded
Doehler Die Cast. Co., Brooklyn
Franklin Die Cast. Corp. Syracuse
Gilbert & Barker Mfg. Co., Springfield, Mass.
Light Mfg. & Fdry. Co., Pottstown
Marf Mch. & Die Casting Co., Bklyn.

Castings, Iron
Athol Mach. & Fdry. Co., Athol
Birdsboro Steel F. & M. Co., Birdsboro
Brown & Sharpe Mfg. Co., Providence
Chisholm-Moore Mfg. Co., Cleveland
Du Pont Eng. Co., Wilmington
Franklin Mach. Co., Providence
Springfield Mch. T. Co., Springfield, O.
Whitcomb-Blaisdell Mch. Tool Co., Worcester.

Castings, Malleable Iron
Link-Belt Co., Chicago, Philadelphia

Castings, Semi-Steel
Springfield Mch. T. Co., Springfield, O.

Cement, Iron
Hilo Varnish Corp., Brooklyn

Centering Machines
Pawling & Harnischfeger Co., Milwaukee
Standard Eng. Wks., Pawtucket
Whiton Mch. Co., D. E., New London

Centers, Planer
Cincinnati Planer Co., Cincinnati

Chains (See Sprockets and Chains)

Chains, Driving
Baldwin Chain & Mfg. Co., Worcester
Link-Belt Co., Philadelphia, Chicago
Morse Chain Co., Ithaca
Philadelphia Gear Wks., Philadelphia
Whitney Mfg. Co., Hartford

Chucking Machines
Brown & Sharpe Mfg. Co., Providence
Bullard Mach. Tool Co., Bridgeport
Cleveland Auto. Mach. Co., Cleveland
Gisholt Mach. Co., Madison
Jones & Lamson Mch. Co., Springfield, Vt.
Potter & Johnston Mch. Co., Pawtucket
Warner & Swasey Co., Cleveland

Chucks, Air
Frontier Chuck & Tool Co., Buffalo
Hannifin Mfg. Co., Chicago

Chucks, Centering
Cushman Chuck Co., Hartford

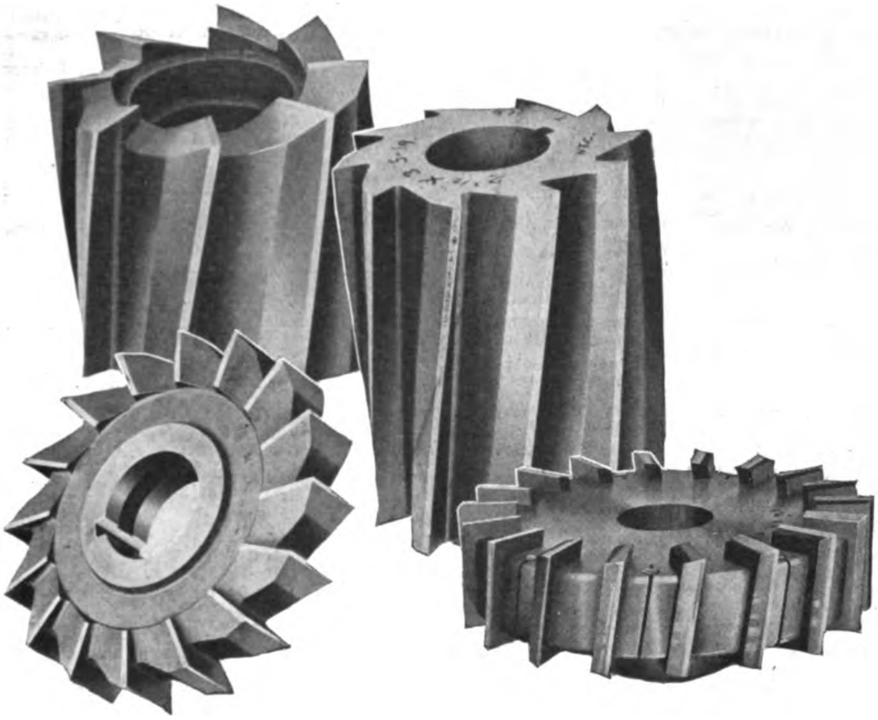
Chucks, Drill and Tap
Almond Mfg. Co., T. R., Ashburnham
American Equip. Co., Detroit
Cushman Chuck Co., Hartford
Horton & Son Co., E., Windsor Locks
Jacobs Mfg. Co., Hartford
Marvin & Casler Co., Canastota
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Scully-Jones Co., Chicago
Skinner Chuck Co., New Britain
Trump Bros. Mch. Co., Wilmington
Union Mfg. Co., New Britain
Victor Tool Co., Waynesboro
Whitney Mfg. Co., Hartford
Whiton Mch. Co., D. E., New London

Chucks, Lathe
Almond Mfg. Co., T. R., Ashburnham
Bullard Mach. Tool Co., Bridgeport.
Cushman Chuck Co., Hartford
Gisholt Machine Co., Madison
Hoggson & Pettis Mfg. Co., New Haven
Horton & Son Co., E., Windsor Locks
Skinner Chuck Co., New Britain
Union Mfg. Co., New Britain
Whiton Mch. Co., D. E., New London

Chucks, Magnetic
Heald Mach. Co., Worcester
Walker Co., O. S., Worcester

Chucks, Planer
Cincinnati Planer Co., Cincinnati
Hoggson & Pettis Mfg. Co., New Haven.
Horton & Son Co., E., Windsor Locks
Skinner Chuck Co., New Britain
Union Mfg. Co., New Britain
Walker Co., O. S., Worcester

Chucks, Quick Changing
Geometric Tool Co., New Haven



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Spur and Worm Gear Hobs

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We have built a reputation for designing and making cutting tools that take the lag out of production. By their longer life, freedom from grinding delays, and their power efficiency, they pay for themselves many times over.

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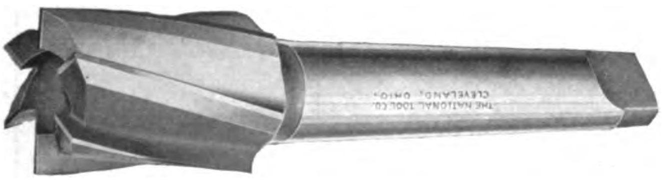

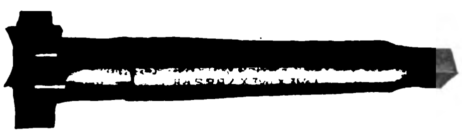

Chucks, Split
Ames Co., B. C., Waltham.
Rivett Lathe & Grinder Co., Boston
Seneca Falls Mfg. Co., Seneca Falls
Stark Tool Co., Waltham
Wade-American Tool Co., Waltham

Chucks, Vertical Boring Mill
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Gisholt Machine Co., Madison

Clamps, Machinists'
Armstrong Bros. Tool Co., Chicago
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Starrett Co., L. S., Athol
Williams & Co., J. H., Brooklyn

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Moore & White Co., Philadelphia.

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Shepard Elec. C. & H. Co., Montour Falls

Coal-Storage Systems
Link-Belt Co., Chicago, Philadelphia

Coils, Electric
General Electric Co., Schenectady

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Collars, Spacing
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Scully-Jones Co., Chicago

Collets
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McCrosky Tool Corp., Meadville
Ransom & Randolph Co., Toledo
Rivett Lathe & Grinder Co., Boston
Standard Eng. Wks., Pawtucket
Union Twist Drill Co., Athol
Whitney Mfg. Co., Hartford

Compounds, Carbonizing, Case Hardening and Tempering
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Shore Instrument & Mfg. Co., N. Y.

Compounds, Cleaning
Oakley Chemical Co., N. Y.

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Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

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Black & Decker Mfg. Co., Baltimore
Bury Compressor Co., Erie
Chicago Pneumatic Tool Co., N. Y.
General Electric Co., Schenectady
Sullivan Mchy. Co., Chicago

Compressors, Electric
Black & Decker Mfg. Co., Baltimore

Conduits, Interior
General Electric Co., Schenectady

Cones, Friction
Evans Fric. Cone Co., Newton Highlands

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American Tool & Mfg. Co., Urbana
Ames Co., B. C., Waltham
Barber-Colman Co., Rockford
Bath & Co., John, Worcester
Barth Stamping & Mach. Wks., Cleveland.
Becker Mill. Mch. Co., Hyde Park
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Boeger-Meyer Mch. & T. Co., Newark
Boston Scale & Mach. Co., Boston
Brock Tool & Mfg. Works, A., Phila.
Brown & Sharpe Mfg. Co., Providence
Columbus (O.) Die T. & M. Co.
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Du Pont Eng. Co., Wilmington
Earle Gear & Mach. Co., Phila.
East End Mch. Wks., Appleton
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Hartford Special Mchy., Hartford
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Johnston Tool & Mfg. Co., Chappaqua
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Kempsmith Mfg. Co., Milwaukee
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Lincoln Mach. Co., Pawtucket
Marf Machine Co., N. Y.
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Mehl Mch. T. & Die Co., Roselle
Meisel Press Mfg. Co., Boston
Meldrum Gabrielson Corp., Syracuse
Robinson Tool Wks., Waterbury
Rowbottom Mach. Co., Waterbury
Simplex Tool Co., Woonsocket
Steel Products Eng. Co., Springfield, O.
Underwood Corp., H. B., Philadelphia
Wade-American Tool Co., Waltham
Waltham Mach. Wks., Waltham

Controllers & Starters, Elect.
General Electric Co., Schenectady

Converters
General Electric Co., Schenectady

Conveyors and Elevators (See Elevators)

Cotter Pins
Williams & Co., J. H., Brooklyn

Counterbores
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Slocomb Co., J. T., Providence

Counters, Revolution
Bristol Co., Waterbury

Countershafts
Brown & Sharpe Mfg. Co., Providence
Diamond Mach. Co., Providence
Evans Fric. Cone Co., Newton Highlands
Garvin Mach. Co., N. Y.

Countersinks
Greenfield Tap & Die Corp., Greenfield
Whitman and Barnes Mfg. Co., Akron

Counting and Printing Wheels
Doehler Die Casting Co., Brooklyn
Franklin Die Cast. Corp., Syracuse

Counting Machines
Hart Mfg. Co., R. A., Battle Creek

Couplings, Flexible
Brown Engineering Co., Reading
Dexter Co., I. H. Goshen
Jones Fdry. & Mch. Co., W. A., Chicago
Smith & Serrell, Newark.

Couplings, Hose, Universal
Chicago Pneumatic Tool Co., N. Y.

Couplings, Rigid
Jones Fdry. & Mch. Co., W. A., Chicago
Smith & Serrell, Newark.

Couplings, Shaft
Almond Mfg. Co., T. R. Ashburnham
Dexter Co., I. H. Goshen
Edgemont Mch. Co., Dayton
Johnson Mach. Co., Carlyle, Manchester
Nicholson & Co., W. H., Wilkes-Barre
Royersford F. & M. Co., Royersford
Smith & Serrell, Newark.

Cranes, Electric (See Hoists, Electric)

Cranes, Hand (See Hoists, Hand)

Cranes, Locomotive
Link-Belt Co., Chicago, Philadelphia

Cranes, Traveling
Canton Fdry. & Mch. Co., Canton
Chisholm Moore Mfg. Co., Cleveland
Harrington, Son & Co., Ed., Phila
Link-Belt Co., Chicago Philadelphia
Northern Eng. Wks., Detroit
Pawling & Harnischfeger Co., Milwaukee
Reading Chain Block Corp., Reading
Shepard Elec. C. & H. Co., Montour Falls
Toledo Crane Co., Bucyrus

Crank Pin Turning Machines
Underwood Corp., H. B., Philadelphia

Cut-Out, Electrical
General Electric Co., Schenectady

Cutters, Gear
Brown & Sharpe Mfg. Co., Providence
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol

Cutters, Milling
Barber-Colman Co., Rockford
Becker Milling Mch. Co., Hyde Park
Brown & Sharpe Mfg. Co., Providence
Cowles Tool Co., Cleveland
Geometric Tool Co., New Haven
Ingersoll Milling Mch. Co., Rockford
Lovejoy Tool Co., Springfield, Vt.
Morse Twist D. & Mch. Co., New Bedford
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Ransom & Randolph Co., Toledo
Union Twist Drill Co., Athol
Whitney Mfg. Co., Hartford

Cutters, Thread
Rivett Lathe & Grinder Co., Boston
Universal Mch. Co., Bowling Green

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
Earle Gear & Mach. Co., Phila.
Etna Mch. Co., Toledo
Garvin Mach. Co., N. Y.
Gorton Mach. Co., Geo., Racine
Greenfield Tap & Die Corp., Greenfield
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Vandyck Churchill Co., N. Y.

Cutting-Off Machines, Pipe (See Pipe Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago
Pratt & Whitney Co., Hartford
Western T. & Mfg. Co., Springfield, O.
Williams & Co., J. H., Brooklyn

Cutting Oil Filters (See Oil Filtering Systems)

Dealers, Machinery (See Searchlight Section)
Allen, Harry F., New York
Bertolette Mch. T. Co., Jersey City
Botwinik Bros., New Haven
Brownell Mchy. Co., Providence
Essley Mchy. Co., Chicago
Factory & Mill Supply Co., Boston
Froiland, Paul, Springfield, Ill.
Garvin Mach. Co., N. Y.
Gelb & Co., J., N. Y.
Harris Bros. Co., Chicago
Hill, Clarke & Co., Chicago
Hyman & Sons, Jos., Philadelphia
Ideal Machy. Co., Plainsville
Industrial Plants Corp., N. Y. C.
Lamberg & Co., A., N. Y.
Lucas & Son, J. L., Bridgeport
McMullen Mchy. Co., Grand Rapids
Machinery Dealers, Inc., New Haven
Miles Mchy Co., Saginaw
Morey & Co., N. Y.
New Britain Mch. Co., New Britain
N. J. Mchy. Exch., Newark
Niles & Co., F. H., Jersey City
Niles-Bement-Pond Co., N. Y.
Osborne & Sexton Mchy Co., Columbus
Pattison Supply Co., W. M., Cleveland
Prentiss & Co., Henry, N. Y.
Silber, Walter, Brooklyn
Simmons Mch. Co., Albany
Snyder Corp., S., Rochester
Stokvis & Sons, R. S., N. Y.
Toomey, Inc., Frank, Philadelphia
Vandyck Churchill Co., N. Y.
Wayne Mchy. Co., Fort Wayne

Demagnetizers
Luma Elect. Equip. Co., Toledo

Diamond Tools
Crafts & Co., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana
Dickinson, Thomas L., N. Y.
Wheel Trueing Tool Co., Detroit

Die Making Machines
Anderson Die Mch. Co., Bridgeport
Johnson Tool Co., Providence
Keller Mech. Eng. Co., Brooklyn

Dies, Forging
Keller Mech. Eng. Co., Brooklyn
Steel Products Eng. Co., Springfield, O.

Dies, Self Opening, Adjustable
Eastern Mach. S. Corp., New Haven
Geometric Tool Co., New Haven
Jones & Lamson Mach Co., Springfield, Vt.
Murchey Mch. & Tool Co., Detroit
Victor Tool Co., Waynesboro.

Dies, Sheet-Metal and Sub-Press (See Tool Work)

Dies, Threading-Opening
Eastern Mch. S. Corp., New Haven
Errington Mech. Laboratory, N. Y.
Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro
Murchey Mch. & Tool Co., Detroit
National Acme Co., Cleveland
National Mchy. Co., Tiffin
Steel Products Eng. Co., Springfield, O.
Victor Tool Co., Waynesboro.
Warner & Swasey Co., Cleveland

Dividing Heads
Knight Mchy. Co., W. B., St. Louis

Dogs, Lathe and Milling Machine
Armstrong Bros. Tool Co., Chicago
Williams & Co., J. H., Brooklyn

Drafting Boards & Tables
N. Y. Blue Print Paper Co., N. Y.

Drafting Materials
N. Y. Blue Print Paper Co., N. Y.

Dressers, Grinding Wheel
Bay State Stamp. Co., Worcester
Crafts & Co., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana
Norton Co., Worcester

Drill Holders
Armstrong Bros. Tool Co., Chicago

Drill Speeders
Graham Mfg. Co., Providence
Turner Mach. Co., Danbury

Drilling Attachments
Hjorth Lathe & Tool Co., Boston

Drilling Attachments, Offset
Harris Engineering Co., Bridgeport

Drilling Machine Heads
Baush Mch. T. Co., Springfield, Mass.
Hoefer Mfg. Co., Freeport.
Langelier Mfg. Co., Cranston
Nelson-Blanck Mfg. Co., Detroit

Drilling Machines, Automatic
Baker Bros., Toledo
Baush Mch. T. Co., Springfield, Mass.
Langelier Mfg. Co., Cranston
Nat'l Automatic Tool Co., Richmond
Rockford (Ill.) Drilling Mach. Co.

Drilling Machines, Bench
Ames Co., B. C., Waltham
Barnes Co., W. F. & John, Rockford
Cincinnati (O.) Electrical Tool Co.
Henry & Wright Mfg. Co., Hartford
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Cranston
Millers Falls Co., Millers Falls
Pratt & Whitney Co., Hartford
Robinson Tool Wks., Waterbury
Silver Mfg. Co., Salem
Standard Elect. T. Co., Cincinanti
Taylor & Fenn Co., Hartford

Drilling Machines, Electric and Pneumatic
Black & Decker Mfg. Co., Baltimore
Chicago Pneumatic Tool Co., N. Y.
Cincinnati (O.) Elect. Tool Co.
Louisville Elec Mfg. Co., Louisville.
Neil & Smith Elec. T. Co., Cincinnati
Silver Mfg. Co., Salem
Standard Elect. T. Co., Cincinanti
U. S. Elect. Tool Co., Cincinnati
Wisconsin Elect Co., Racine

Drilling Machines, Gang
Baker Bros., Toledo
Barnes Drill Co., Rockford
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Henry & Wright Mfg. Co., Hartford
Langelier Mfg. Co., Cranston
Moline Tool Co., Moline
Silver Mfg. Co., Salem, O.
Taylor & Fenn Co., Hartford

Drilling Machines, Heavy Duty
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Buffalo Forge Co., Buffalo
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Hoefer Mfg. Co., Freeport
Minster Mch. Co., Minster
Ryerson & Son, Jos. T., Chicago

Drilling Machines, Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Drilling Machines, Multiple Spindle
Baker Broos., Toledo
Baush Mch. T. Co., Springfield, Mass.
Foote-Burt Co., Cleveland
Fox Mch. Co., Jackson, Mich.
Harrington Son & Co., Ed., Phila.
Langelier Mfg. Co., Cranston
National Acme Co., Cleveland
Nat'l Automatic Tool Co., Richmond
Newton Mch. T. Plant, Cons. Mch T. Corp. of America, Philadelphia
Rockford (Ill.) Drilling Mach. Co.
Sellers & Co., Wm., Philadelphia
Turner Mach. Co., Danbury

Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Baush Mch. T. Co., Springfield, Mass.
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Cincinnati (O.) Bickford Tool Co.
Dreses Mach. Tool Co., Cincinnati
Fosdick Mach. Tool Co., Cincinnati
Harrington Son & Co., Ed., Phila.
Henry & Wright Mfg. Co., Hartford
Morris Mach. Tool Co., Cincinnati
Mueller Mach. Tool Co., Cincinnati
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Reed-Prentice Co., Worcester
Ryerson, Jos. T. & Son, Chicago
Sellers & Co., Wm., Philadelphia

Drilling Machines, Sensitive
Buffalo Forge Co., Buffalo
Henry & Wright Mfg. Co., Hartford
Langelier Mfg. Co., Cranston
Leland-Gifford Co., Worcester
Reed-Prentice Co., Worcester
Royersford F. & M. Co., Royersford
Taylor & Fenn Co., Hartford
Wisconsin Elect Co., Racine

Drilling Machines, Turret
Nat'l Automatic Tool Co., Richmond
Turner Mach. Co., Danbury

Drilling Machines, Vertical
Baker Broos., Toledo
Barnes Drill Co., Rockford
Barnes Co., W. F. & John, Rockford
Baush Mch. T. Co., Springfield, Mass.
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Cincinnati (O) Bickford Tool Co.

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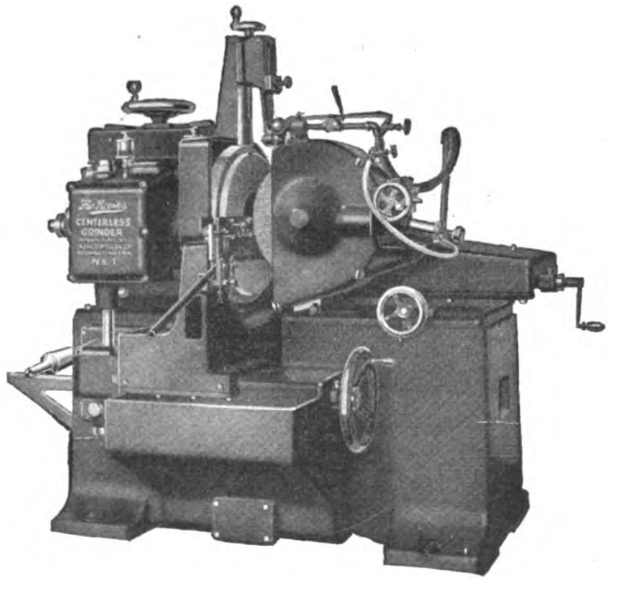

Reeves Pulley Company

Columbus, Indiana

Foote-Burt Co., Cleveland
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Knight Mchy. Co., W. B., St. Louis
Langelier Mfg. Co., Cranston
Leland-Gifford Co., Worcester
Reed-Prentice Co., Worcester
Royersford F. & M. Co., Royersford
Ryerson & Son, Jos. T., Chicago
Silver Mfg. Co., Salem, O.
Taylor & Fenn Co., Hartford
Turner Mach. Co., Danbury

Drills, Center
Gledhill Mfg. Co., Providence
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Slocomb Co., J. T., Providence
Union Twist Drill Co., Athol
Whitman & Barnes Mfg. Co., Akron

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago
Greene, Tweed & Co., N. Y.
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol
Whitman & Barnes Mfg. Co., Akron

Drills, Twist and Flat
Buckeye Twist Drill Co., Alliance
Latrobe Tool Co., Latrobe
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Union Twist Drill Co., Athol
Whitman & Barnes Mfg. Co., Akron

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Akron Sheet Metal Co., Akron

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General Electric Co., Schenectady

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General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Electrical Supplies
General Electric Co., Schenectady
Simplex Wire & Cable Co., Boston
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Elevating Trucks (See Trucks)

Elevators and Conveyors
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Caldwell & Son Co., H. W., Chicago
Dillon Elec. Co., Canton
Link-Belt Co., Chicago, Philadelphia

Emery Wheels (See Grinding Wheels)

Enamels, Machinery
Hilo Varnish Corp., Brooklyn

Engines, Oil, Gas & Steam
Chicago Pneumatic Tool Co., N. Y.

Engineers, Industrial and Mechanical
Bath & Co., John, Worcester
Hartford Special Mchy. Co., Hartford
Underwood Corp., H. B., Philadelphia

Engraving Machinery
Gorton Mach. Co., Geo., Racine
Keller Mech. Engr. Co., Brooklyn

Expanders, Tube
Watson-Stillman Co., N. Y.

Eyeglasses, Safety (See Goggles, Safety)

Fans, Electric
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans, Exhaust
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans, Ventilating
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

File Handles
Osgood Tool Co., J. L., Buffalo
Parker Supply Co., N. Y.
Nicholson File Co., Providence

Files
American Swiss File & T. Co., N. Y.

Files and Rasps
Delta File Wks., Philadelphia
Nicholson File Co., Providence

Filing Machines
Ames Co., B. C., Waltham
Cochrane-Bly Co., Rochester
Oliver Instrument Co., Adrian, Mich.
Robinson Tool Wks., Waterbury

Filing Machines Saw
Wardwell Mfg. Co., Cleveland

Filler, Iron (See Cements, Iron)

Fittings, Hydraulic
Burroughs Co., Newark
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Flexible Shafts
Errington Mech. Laboratory, N. Y.
Strand & Co., N. A., Chicago

Forging Machinery
Acme Mchy. Co., Cleveland
Bradley & Son, C. C., Syracuse
National Machinery Co., Tiffin

Forgings, Drop
Bearings Co. of America, Lancaster
Universal Mch. Co., Bowling Green
Williams & Co., J. H., Brooklyn

Foundry Equipment
Adams Co., Dubuque

Fountains, Drinking
Manufacturing Equipment & Eng. Co., Framingham

Fuel Oil Burning System
Advance Furnace & Eng. Co., Springfield, Mass.
Chicago Flexible Shaft, Chicago

Furnaces, Forging
American Gas Furnace Co., Elizabeth
Chicago Flexible Shaft Co., Chicago

Furnaces, Heat Treating Coal
American Industrial Furnace Corp., Boston

Furnaces, Heat Treating Oil and Gas
Advance Furnace & Eng. Co., Springfield, Mass.
American Gas Furnace Co., Elizabeth
American Industrial Furnace Corp., Boston
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
Johnson Gas Appliance Co., Cedar Rapids

Furnaces and Ovens, Electric
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Furnaces, Tempering and Annealing
Advance Furnace & Eng. Co., Springfield, Mass.
American Gas Furnace Co., Elizabeth
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
General Electric, Schenectady
Johnson Gas Appliance Co., Cedar Rapids

Furniture, Machine Shop
Brown Engineering Co., Reading
Manufacturing Equip. & Eng. Co., Framingham

Gage Blocks
Bath & Co., John, Worcester
Pratt & Whitney Co., Hartford

Gages, Comparator
Jones & Lamson Mach. Co., Springfield, Vt.

Gages, Dial
Ames Co., B. C., Waltham
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham
Starrett Co., L. S., Athol

Gages, Micrometer Plug
Bath & Co., John, Worcester

Gages, Plug & Ring
Bath & Co., John, Worcester

Gages, Recording
Bristol Co., Waterbury

Gages, Snap, Thread and Cylindrical
Bath & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
Greenfield Tap & Die Corp., Greenfield
Meldrum Gabrielson Corp., Syracuse
Pratt & Whitney Co., Hartford

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Greenfield Tap & Die Corp., Greenfield
Hartford Spec. Mchy. Co., Hartford
Pratt & Whitney Co., Hartford

Gaskets
Greene, Tweed & Co., N. Y.

Gear Blanks
Hartford Mch. Screw Co., Hartford

Gear-Cutting Machines
Adams Co., Dubuque
Barber-Colman Co., Rockford
Becker Milling Mch. Co., Hyde Park
Bilgram Mach. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Gear Cutting Mch. Co.
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
Garvin Mach. Co., N. Y.
Gleason Wks., Rochester
Gould & Eberhardt, Newark
Harrington, Son & Co., Ed., Phila.
Newark Gear Cut. Mch. Co., Newark
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Waltham Mach. Wks., Waltham
Whiton Mch. Co., D. E., New London

Gear Tempering Machinery
Gleason Wks., Rochester

Gear Testing Machinery
Adams Co., Dubuque
Brown & Sharpe Mfg. Co., Providence
Gisholt Mach. Co., Madison
Gleason Wks., Rochester
Newark Gear Cut. Mch. Co., Newark

Gear Tooth Rounders
Cross Gear & Eng. Co., Detroit

Gears, Cast
Brown & Sharpe Mfg. Co., Providence
Brown Co., A. & F., N. Y.
Caldwell & Son Co., H. W., Chicago
Franklin Die Cast. Corp., Syracuse
Grant Gear Wks., Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Mch. Co., W. A., Chicago
Link-Belt Co., Chicago, Philadelphia
Philadelphia Gear Wks., Philadelphia

Gears, Cut
Adams Co., Dubuque
Albaugh Dover Co., Chicago
Albro-Clem Elevator Co., Phila.
Baush Mch. T. Co., Springfield, Mass.
Bilgram Mach. Wks., Philadelphia
Boston Gear Wks., Quincy.
Brown & Sharpe Mfg. Co., Providence
Brown Co., A. & F., N. Y.
Cincinnati Gear Co., Cincinnati
Connecticut Gears, Waterbury
Diefendorf Gear Corp., Syracuse
Earle Gear & Mach. Co., Phila.
Fawcus Mach. Co., Pittsburgh
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
Foote Bros. Gear & M. Co., Chicago
Garvin Mach. Co., N. Y.
General Electrc Co., Schenectady
Gleason Wks., Rochester
Grant Gear Wks., Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Mch. Co., W. A., Chicago
Link-Belt Co., Chicago, Philadelphia
Massachusetts Gear & T. Co., Woburn
Meacham Gear Corp., Syracuse
Meisel Press Mfg. Co., Boston
Newark Gear Cut. Mch. Co., Newark
Niles-Bement-Pond Co., New York
Philadelphia Gear Wks., Philadelphia
Simonds Mfg. Co., Pittsburgh

Gears, Forged
Philadelphia Gear Wks., Philadelphia

Generators, Electric
Reliance Elec. & Eng. Co., Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Grab Buckets
Link-Belt Co., Chicago, Philadelphia
Toledo Crane Co., Bucyrus

Greases, Lubricating
Royersford F. & M. Co., Royersford
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Grinding Machines, Ball Bearing Race (See Grinding Machines, Radial)

Grinding Machines, Bench
Athol Mach. & Fdry. Co., Athol
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Elect. Tool Co.
Diamond Mach. Co., Providence
Dillon Elec. Co., Canton
Greenfield Tap & Die Corp., Greenfield
Liberty Tool Co., Irvington
Louisville Elec. Mfg. Co., Louisville
Marschke Mfg. Co., Indianapolis
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Ryerson & Son, Jos. T. Chicago
Safety Emery Wheel Co., Springfield, O.
Standard Elect. T. Co., Cincinnati
Union Twist Drill Co., Athol
U. S. Elect. Tool Co., Cincinnati
Walker Co., O. S., Worcester

Grinding Machines, Center
Cincinnati (O.) Elect. Tool Co.
Louisville Elect Mfg. Co., Louisville
Standard Elect. T. Co., Cincinnati

Grinding Machines, Centerless
Reeves Pulley Co., Columbus

Grinding Machines, Chaser
Geometric Tool Co., New Haven
National Acme Co., Cleveland

Grinding Machines, Chucking
Blanchard Mach. Co., Cambridge
Bryant Chuck Grinder Co., Springfield, Vt.
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Van Norman Mach. Tool Co., Springfield, Mass.

Grinding Machines, Cutter and Reamer
Armstrong Bros. Tool Co., Chicago
Barnes Co., W. F. & John, Rockford
Blount Co., J. G., Everett
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Gear Cutting Mch. Co.
Cincinnati (O) Milling Mch. Co.
Diamond Mach. Co., Providence
Garvin Mach. Co., N. Y.
Gisholt Mach. Co., Madison
Grand Rapids Grind Mch. Co., Grand Rapids
Greenfield Tap & Die Corp., Greenfield
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
LeBlond Mch. T. Co., R.K., Cincinnati
Liberty Tool Co., Irvington
Norton Co., Worcester
Pratt & Whitney Co., Hartford
Safety Emery Wheel Co., Springfield, O.

Sellers & Co., Wm., Philadelphia
Sterling Grind. Wheel Co., Tiffin, O.
Taylor & Fenn Co., Hartford
Union Twist Drill Co., Athol
Universal Grind. Mch. Co., Fitchburg
Walker Co., O. S., Worcester

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence
Bryant Chuck Grinder Co., Springfield, Vt.
Fitchburg Grind. Mch. Co., Fitchburg
Heald Mach Co., Worcester
Landis Tool Co., Waynesboro
Liberty Tool Co., Irvington
Pratt & Whitney Co., Hartford
Norton Co., Worcester
Rivett Lathe & Grinder Co., Boston
Sanford Mfg. Co., F. C., Bridgeport
Universal Grind. Mch. Co., Fitchburg
Van Norman Mach. Tool Co., Springfield, Mass.
Walker Co., O. S., Worcester
Whitney & Son, Baxter D., Winchendon

Grinding Machines, Die
Abrasive Mch. T. Co., E. Providence
Bignall & Keeler Mch. Co., Edwardsville
Blanchard Mach. Co., Cambridge
Diamond Mach. Co., Providence
Geometric Tool Co., New Haven
Heald Mach. Co., Worcester
Murchey Mch. & Tool Co., Detroit
National Acme Co., Cleveland
National Mchy. Co., Tiffin
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Disc
Badger Tool Co., Beloit
Besly & Co., Charles H., Chicago
Diamond Mach. Co., Providence
Gardner Mch. Co., Beloit
Graham Mfg. Co., Providence
Rowbottom Mach. Co., Waterbury
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Drill
Grand Rapids Grind Mch. Co., Grand Rapids
La Salle Tool Co., La Salle
Greenfield Tap & Die Corp., Greenfield
Louisville Elect. Mfg. Co., Louisville
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadelphia
Sterling Grind. Wheel Co., Tiffin, O.

Grinding Machines, Face
Blanchard Mach. Co., Cambridge
Diamond Mach. Co., Providence
Graham Mfg. Co., Providence

Grinding Machines, Floor
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Elect. Tool Co.
Diamond Mach. Co., Providence
Dillon Elec. Co., Canton
Forbes & Myers, Worcester
Glow Elec. Co., Cincinnati
La Salle Tool Co., La Salle
Louisville Elect Mfg. Co., Louisville
Marschke Mfg. Co., Indianapolis
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Royersford F. & M. Co., Royersford
Ryerson & Son, Jos. T., Chicago
Safety Emery Wheel Co., Springfield, O.
Sterling Grand. Wheel Co., Tiffin

Grinding Machines, Gage
Abrasive Mch. T. Co., E. Providence
Landis Tool Co., Waynesboro
Rivett Lathe & Grind. Co., Boston
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Hob
Harris Engineering Co., Bridgeport

Grinding Machines, Internal
Bryant Chuck Grinder Co., Springfield, Vt.
Garvin Mach. Co., N. Y.
Greenfield Tap & Die Corp., Greenfield
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Liberty Tool Co., Irvington
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Universal Grind. Mch. Co., Fitchburg
Van Norman Mch. T. Co., Springfield, Mass.
Walker Co., O. S., Worcester
Whitney & Son, Baxter D., Winchendon

Grinding Machines, Portable,
Armstrong-Blum Mfg. Co., Chicago
Black & Decker Mfg. Co., Baltimore
Chicago Pneumatic Tool Co., N. Y.
Cincinnati (O.) Elect. Tool Co.
Dillon Elec. Co., Canton
Forbes & Myers, Worcester
Hergi Mfg. Co., Bridgeport
Liberty Tool Co., Irvington
Louisville Elect. Mfg. Co., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Stroud, Arva, N. Y.
U. S. Elect. Tool Co., Cincinnati
Wisconsin Elect. Co., Racine

Grinding Machines, Radial
Landis Tool Co., Waynesboro
Rivett Lathe & Grinder Co., Boston
Van Norman Mach. Tool Co., Springfield, Mass.


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Grinding Machines, Ring Wheel
Badger Tool Co., Beloit
Besly & Co., Charles H., Chicago
Diamond Mach. Co., Providence
Gardner Mch. Co., Beloit

Grinding Machines, Snagging
Blount Co., J. G., Everett
Diamond Mach. Co., Providence
Dillon Elec. Co., Canton
Ransom Mfg. Co., Oshkosh
U. S. Elect. Tool Co., Cincinnati
Walker Co., O. S., Worcester

Grinding Machines, Surface
Abrasive Mch. T. Co., E. Providence
Blanchard Mach. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Diamond Mach. Co., Providence
Graham Mfg. Co., Providence
Heald Mach. Co., Worcester
La Salle Tool Co., La Salle
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Norton Co., Worcester
Pratt & Whitney Co., Hartford
Rowbottom Mach. Co., Waterbury
Safety Emery Wheel Co., Springfield, O.
Walker Co., O. S., Worcester

Grinding Machines Thread
Bath & Co., John, Worcester

Grinding Machines Tool Post
Liberty Tool Co., Irvington

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Chicago Pneumatic Tool Co., N. Y.
Gisholt Mach. Co., Madison
Grand Rapids Grind Mch. Co., Grand Rapids
Greenfield Tap & Die Corp., Greenfield
Landis Tool Co., Waynesboro
Norton Co., Worcester
Wilmarth & Morman Co., Grand Rapids

Grinding Wheels
Carborundum Co., Niagara Falls
Dickinson, Thomas L., N. Y.
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Sterling Grind. Wheel Co., Tiffin
Vitrified Wheel Co., Westfield

Guides, Elevator
Standard Gauge Steel Co., Beaver Falls

Gun-Barrel Machinery
Baush Mch. T. Co., Springfield, Mass.
Pratt & Whitney Co., Hartford

Hammers, Drop
Bradley & Son, C. C., Syracuse

Hammers, Electric
Beaudry & Co., Boston

Hammers, Forging
Nazel Eng. Mch. Wks, Philadelphia

Hammers, Pneumatic
Chicago Pneumatic Tool Co., N. Y.

Hammers, Power
Beaudry & Co., Boston
Bliss & Co., E. W., Brooklyn
Bradley & Son, C. C., Syracuse
Nazel Eng. & Mch Wks., Phila.
Ryerson, Jos. T. & Son, Chicago
West Tire Setter Co., Rochester

Handles, Machine
Rockwood Sprinkler Co., Worcester

Hangers, Shafting
Armstrong Bros., Tool Co., Chicago
Brown & Sharpe Mfg. Co., Providence
Jones Fdry. & Mch. Co., W. A., Chicago
Royersford F. & M. Co., Royersford

Hardening, Case-Hardening and Tempering
Hartford Mch. Screw Co., Hartford
General Mach. Wks., York

Hardness Testing Apparatus
Shore Instrument & Mfg. Co., N. Y.

Heaters, Electric Water
Bridgeport Mch. & T. Mfg. Co., Bridgeport

Hobbing Machines
Adams Co., Dubuque
Barber-Colman Co., Rockford
Cincinnati (O) Gear Cutting Mch. Co.
Gould & Eberhardt, Newark
Newark Gear Cut. Mch. Co., Newark

Hobs
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Greenfield Tap & Die Corp., Greenfield
National Tool Co., Cleveland
Newark Gear Cut Mch. Co., Newark
Philadelphia Gear Wks., Philadelphia
Union Twist Drill Co., Athol

Hoists and Cranes, Electric
Link-Belt Co., Chicago, Philadelphia
Northern Eng. Wks., Detroit
Pawling & Harnischfeger Co., Milwaukee
Reading Chain Block Corp., Reading
Shepard Elec. C. & H. Co., Montour Falls
Toledo Crane Co., Bucyrus

Hoists, Hand
Canton Fdry. & Mach. Co., Canton
Chisholm-Moore Mfg. Co., Cleveland
Ford Chain Block & Mfg. Co., Phila.
Harrington, Son & Co., Ed., Phila.
Reading Chain Block Co., Reading

Hoists, Pneumatic
Chicago Pneumatic Tool Co., N. Y.
Sullivan Machy Co., Chicago

Holders-On, Pneumatic
Chicago Pneumatic Tool Co., N. Y.

Hydraulic Leather
Schieren Co., Chas. A., N. Y.

Hydraulic Machinery
Oilgear Co., Milwaukee
Watson-Stillman Co., N. Y.

Igniters, Gas Engine
Doehler Die Casting Co., Brooklyn

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence
Marvin & Casler Co., Canastota
Starrett Co., L. S., Athol

Industrial Illumination
Cooper-Hewitt Elec. Co., Hoboken

Jacks, Hydraulic
Watson-Stillman Co., N. Y.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago

Japans
Hilo Varnish Corp., Brooklyn

Jigs & Fixtures (See Contract Work)

Kettles, Soda
Brown & Sharpe Mfg. Co., Providence
Gray & Prior Mach. Co., Hartford

Keyseating Machines
Baker Bros., Toledo
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson
Mitts & Merrill, Saginaw
Morton Mfg. Co., Muskegon Heights
National Mch. Tool Co., Cincinnati
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia

Keys, Machine
Moltrup Steel Products, Beaver Falls
Morton Mfg. Co., Muskegon Heights
Whitney Mfg. Co., Hartford

Knurl Holders
Williams & Co., J. H., Brooklyn

Lamps, Electrical
Cooper-Hewitt Elec. Co., Hoboken
General Electric Co., Schenectady

Lathe Attachments
Ames Co., B. C., Waltham
Dalton Mfg. Co., Sound Beach
Flather & Co., Nashua
Rivett Lathe & Grinder Co., Boston
Walcott Lathe Co., Jackson

Lathe Tools
Armstrong Bros. Tool Co., Chicago
Gisholt Mach. Co., Madison
Lovejoy Tool Co., Springfield, Vt.
Western T. & Mfg. Co., Springfield, O.
Williams & Co., J. H., Brooklyn

Lathes, Automatic and Semi-Automatic
Gisholt Mach. Co., Madison
Jones & Lamson Mach. Co., Springfield, Vt.
National Acme Co., Windsor, Vt.
Potter & Johnson Mch. Co., Pawtucket
Reed-Prentice Co., Worcester
Steinle Turret Mach. Co., Madison

Lathes, Bench
Ames Co., B. C., Waltham
Blount Co., J. G. Everett
Campbell Mfg. Co., Worcester
Dalton Mfg. Co., Sound Beach
Diamond Mach. Co., Providence
Greenfield Tap & Die Corp., Greenfield
Hjorth Lathe & Tool Co., Boston
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Pratt & Whitney Co., Hartford
Seneca Falls Mfg. Co., Seneca Falls
South Bend Lathe Wks., South Bend
Stark Tool Co., Waltham
Van Norman M. Tool Co., Springfield, Mass.
Wade-American Tool Co., Waltham

Lathes, Boring
Gisholt Mach. Co., Madison
Potter & Johnston Mach. Co., Pawtucket

Lathes, Chucking (See Lathes, Horizontal Turret, and Lathes, Vertical Turret)

Lathes, Engine
American Tool Wks. Co., Cincinnati
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Rockford
Blount Co., J. G., Everett
Bradford, Mch. T. Co., Cincinnati
Carroll-Jamieson Mch. T. C., Batavia
Champion Tool Wks. Co., Cincinnati
Dalton Mfg. Co., Sound Beach
Fitchburg Mach. Wks., Fitchburg
Flather & Co., Nashua
Gisholt Mach. Co., Madison
Greaves Klusman T. Co., Cincinnati
Hamilton Mach. Tool Co., Hamilton
LeBlond M. T. Co., R. K., Cincinnati
Lodge & Shipley Mch. Tool Co., Cincinnati
Monarch Mach. Tool Co., Sidney
Morris Mach. Tool Co., Cincinnati
Mueller Mach. Tool Co., Cincinnati
Myers Mch. Tool Corp., Columbia
Reed-Prentice Co., Worcester
Rockford (Ill.) Drilling Mach. Co.
Rockford (Ill.) Tool Co.
Ryerson, Jos. T. & Son, Chicago
Seneca Falls Mfg. Co., Seneca Falls
Sidney Mch. Tool Co., Sidney
South Bend Lathe Wks., South Bend
Springfield Mch. T. Co., Springfield, Ohio
Walcott Lathe Co., Jackson
Whitcomb-Blaisdell Mach. Tool Co., Worcester

Lathes, Extension and Gap
American Tool Wks. Co., Cincinnati
Barnes Drill Co., Rockford
Harrington Son & Co., Ed., Phila.
Myers Mch. Tool Corp., Columbia

Lathes, Foot Power
Barnes Co., W. F. & John, Rockford
Dalton Mfg. Co., Sound Beach
Seneca Falls Mfg. Co., Seneca Falls

Lathes, Horizontal Turret
Acme Mach. Tool Co., Cincinnati
Dreses Mach. Tool Co., Cincinnati
Foster Mach. Co., Elkhart
Gisholt Mach. Co., Madison
International Mach. Tool Co., Indianapolis
Jones & Lamson Mach. Co., Springfield, Vt.
Millholland Mach. Co., Indianapolis
Pratt & Whitney Co., Hartford
Reed-Prentice Co., Worcester
Steinle Turret Mach. Co., Madison
Warner & Swasey Co., Cleveland

Lathes, Polishing (See Polishing and Buffing Machines)

Lathes, Speed and Hand
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Diamond Mach. Co., Providence
Garvin Mach. Co., N. Y.
Greenfield Tap & Die Corp., Greenfield
Seneca Falls Mfg. Co., Seneca Falls

Lathes, Threading
Automatic Mach. Co., Bridgeport
Rivett Lathe & Grinder Co., Boston

Lathes, Vertical Turret
Bullard Mch. Tool Co., Bridgeport

Lathes, Wood Turning
Barnes Co., W. F. & John, Rockford
Blount Co., J. G., Everett
Seneca Falls Mfg. Co., Seneca Falls

Letters and Figures
Brown & Sharpe Mfg. Co., Providence
Hoggson & Pettis Mfg. Co., New Haven
Pannier Bros. Stamp Co., Pittsburgh

Lighting Fixtures
General Electrc Co., Schenectady
McCrosky Tool Corp., Meadville

Lockers, Clothes
Manufacturing Equip. & Eng. Co., Framingham

Lubricants
Bassick Mfg. Co., Chicago
Oakley Chemical Co., N. Y.
Royersford F. & M. Co., Royersford
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Lubricating Systems
Bassick Mfg. Co., Chicago

Machinists' Small Tools
Armstrong Bros. Tool Co., Chicago
Athol Mach. & Fdry. Co., Athol
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney Co., Hartford
Slocomb Co., J. T., Providence
Randall & Stickney Co., Waltham
Starrett Co., L. S., Athol
Williams & Co., J. H., Brooklyn

Mandrels, Expanding
Bath & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
Nicholson & Co., W. H., Wilkes-Barre
Western T. & Mfg., Springfield, O.

Mandrels, Solid
Brown & Sharpe Mfg. Co., Providence
National Twist D. & T. Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre
Union Twist Drill Co., Athol

Marking Devices (See Stamps, Steel)

Marking Machines
Luma Elect. Equip. Co., Toledo
Martin Mch. Works, Turner's Falls
Noble & Westbrook Mfg. Co., Hartford

Measuring Machines
Norma Co. of America, N. Y.
Pratt & Whitney Co., Hartford

Metal Finishes
Hilo Varnish Corp., Brooklyn

Meters, Steam Flow
General Electrc Co., Schenectady

Micrometer Calipers
Almond Mfg. Co., T. R., Ashburnham
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney Co., Waltham
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol

Milling Attachments
Adams Co., Dubuque
Bath & Co., John, Worcester
Becker Milling Mch. Co., Hyde Park
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mch. Co.
Garvin Mach. Co., N. Y.
Ingersoll Milling Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mch. T. Co., R.K., Cincinnati

Potter & Johnston Mach. Co., Pawtucket
Standard Eng. Wks., Pawtucket

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mch. Co.
Ingersoll Milling Mch. Co., Rockford
Pratt & Whitney Co., Hartford

Milling Machines, Bench
Ames Co., B. C., Waltham
Pratt & Whitney Co., Hartford
Stark Tool Co., Waltham
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Continuous
Ingersoll Milling Mch. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Potter & Johnston Mch. Co., Pawtucket

Milling Machines, Die
Anderson Die Mch. Co., Bridgeport

Milling Machines, Duplex
Cincinnati (O) Milling Mach. Co.
Knight Mchy. Co., W. B., St. Louis
Ingersoll Milling Mach. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia

Milling Machines, Hand
Becker Milling Mch. Co., Hyde Park
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Fox Mach. Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Pratt & Whitney Co., Hartford
Standard Eng. Wks., Pawtucket
Van Norman Mch. T. Co., Springfield Mass.
Whitney Mfg. Co., Hartford

Milling Machines, Horizontal and Planer Type
Beaman & Smith Co., Providence
Betts Mch Plant, Cons. Mch. Tool Corp. of America, Rochester
Ingersoll Milling Mch. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia

Milling Machines, Plain
Becker Milling Mch. Co., Hyde Park
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mch. Co.
Fox Mach. Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Ingersoll Milling Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mch. T. Co., R.K., Cincinnati
Newton Mch. T. Plant, Cons. Mch T. Corp. of America, Philadelphia
Potter & Johnston Mach. Co., Pawtucket
Ryerson, Jos. T. & Son, Chicago
Standard Eng. Wks., Pawtucket
Van Norman Mch. T. Co., Springfield Mass.

Milling Machines, Portable
Ingersoll Milling Mch. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Underwood Corp., H. B., Philadelphia

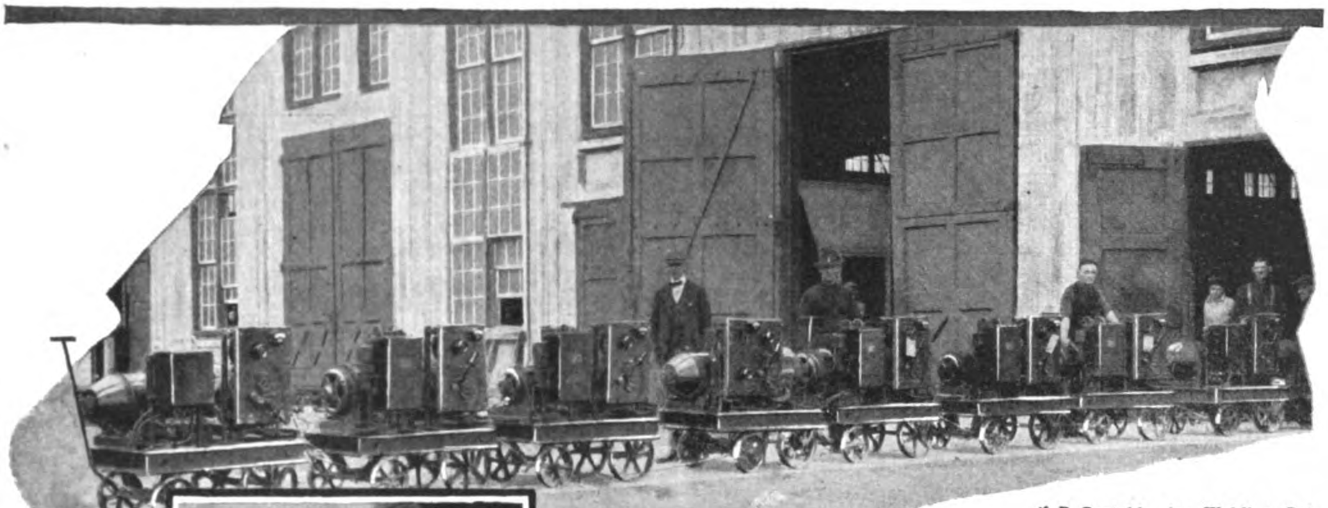
Milling Machines, Thread
Foster Machine Co., Elkhart
Gisholt Mach. Co., Madison
Hall Planetary Thread Milling Mch. Co., Philadelphia
Harrington, Son & Co., Ed., Phila.
Newton Mch. T. Plant, Cons Mch. T. Corp. of America, Philadelphia
Pratt & Whitney Co., Hartford
Waltham Mach. Wks., Waltham

Milling Machines, Universal
Becker Milling Mch. Co., Hyde Park
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mch. Co.
Fox Mach. Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Ingersoll Milling Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Kempsmith Mfg. Co., Milwaukee
LeBlond Mch. T. Co., R.K., Cincinnati
Potter & Johnston Mach. Co., Pawtucket
Ryerson, Jos. T. & Son, Chicago
Van Norman Mach. Tool Co., Springfield, Mass.

Milling Machines, Vertical
Becker Milling Mch. Co., Hyde Park
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mch. Co.
Garvin Mach. Co., N. Y.
Ingersoll Milling Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee
Knight Mchy. Co., W. B., St. Louis
LeBlond Mch. T. Co., R.K., Cincinnati
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Potter & Johnston Mach. Co., Pawtucket
Van Norman, Mach. Tool Co., Springfield, Mass.

Milling Machines, Worm
Cleveland (O.) Automatic Mch. Co.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Waltham Mach. Works, Waltham

Milling Tools, Adjustable Hollow
Geometric Tool Co., New Haven



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General Electric Co., Schenectady
Reliance Elect. & Eng. Co., Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh
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Nut Tappers (See Bolt and Nut Machinery)

Oil and Grease Cups
Bassick Mfg. Co., Chicago
Bay State Stamping Co., Worcester
Bowen Products Corp., Auburn
Gits Bros. Mfg. Co., Chicago
Tucker, W. A. & C. F., Hartford

Oil Filtering and Storage Systems
Oil & Waste Saving Mch. Co., Phila.

Oil Groving Machines
National Mch. T. Co., Cincinnati

Oil Stones
Norton Co., Worcester

Oils
Sun Co., Philadelphia
Texas Co., N. Y.
White & Bagley Co., Worcester

Packing, Hydraulic
Schieren Co., Chas. A., N. Y.

Packing, Steam
Greene, Tweed & Co., N. Y.

Paints, Machinery
Hilo Varnish Corp., Brooklyn

Pattern- Shop Machinery (See Woodworking Machinery)

Patterns, Wood and Metal
Mehl Mach. Tool & D. Co., Roselle

Photographic Duplicating Machines
Photostat Corp., Rochester

Pipe Bending Machines
Harrington, Son & Co., Ed., Phila.
Underwood Corp., H. B., Philadelphia

Pipe Cutting and Threading Machines
Bignall & Keeler Mch. Wks., Edwardsville
Fox Mach. Co., Jackson, Mich.
Greenfield Tap & Die Corp., Greenfield
Harrington & Son Co., Ed., Phila.
Merrell Mfg. Co., Toledo
Murchey Mch. & Tool Co., Detroit

Pipe Fitters' Tools
Butterfield & Co., Derby Line
Greenfield Tap & Die Corp., Greenfield
Saunders Sons, D., Yonkers
Trimont Mfg. Co., Roxbury
Williams & Co., J. H., Brooklyn
Trimont Mfg. Co., Roxbury
Saunders Sons, D., Yonkers
Ryerson & Son, Jos. T., Chicago

Piston-Ring Machines
National Acme Co., Windsor, Vt.
Potter & Johnston Mach. Co., Pawtucket
Walker Co., O. S., Worcester

Planers, Parallels
Walker Co., O. S., Worcester

Planing Machines
American Tool Wks. Co., Cincinnati
Betts Mch. Plant, Cons. Mch. Tool Corp. of America, Rochester
Cincinnati Planer Co., Cincinnati
Gray Co., G. A., Cincinnati
Hamilton Mach. Tool Co., Hamilton
Liberty Mach. T. Co., Hamilton
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Ryerson, Jos. T. & Son, Chicago
Sellers & Co., Wm., Philadelphia
Whitcomb-Blaisdell Mch. Tool Co., Worcester

Planing Machines, Rotary
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Underwood Corp., H. B., Philadelphia

Pneumatic Tools
Anderson Bros. Mfg. Co., Rockford
Chicago Pneumatic Tool Co., Chicago

Polishing and Buffing Machines
Barnes Co., W. F. & John, Rockford
Blanchard Machine Co., Cambridge
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Bryant Chuck Grinder Co., Springfield, Vt.
Diamond Mach Co., Providence
Gardner Mch. Co., Beloit
Glow Elect Co., Cincinnati
Greenfield Tap & Die Corp., Greenfield
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Rivett Lathe & Grinder Co., Boston
Rowbottom Mach. Co., Waterbury
Royersford F. & M. Co., Royersford
Safety Emery Wheel Co., Springfield, O.
Union Twist Drill Co., Athol
Van Norman Mach. Tool Co., Springfield, Mass.
Walker & Co., O. S., Worcester
Wisconsin Elect. Co., Racine

Presses, Arbor
Barnes Co., W. F. & John, Rockford
Crane Puller Co., Arlington
Landis Machine Co., Waynesboro
Nicholson & Co., W. H., Wilkes-Barre

Presses, Drop and Forging
Ams Mch. Co., Max, N. Y.
Bliss Co., E. W., Brooklyn
Elmes Eng. Wks., Charles F., Chicago
Toledo Machine & Tool Co., Toledo
U. S. Tool Co., Newark

Presses, Foot and Hand
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton
Shuster Co., F. B., New Haven
Taylor & Fenn Co., Hartford

Presses, Forcing
Ams Mch. Co., Max, N. Y.
Barnes Co., W. F. & John, Rockford
Lucas Machine Tool Co., Cleveland

Presses, Hydraulic
Burroughs Co., Newark
Elmes Eng. Wks., Charles F., Chicago
Oilgear Co., Milwaukee
Watson-Stillman Co., N. Y.

Presses, Power
Ams Mch. Co., Max, N. Y.
Bliss Co., E. W., Brooklyn
Ferracute Machine Co., Bridgeton
Henry & Wright Mfg. Co., Hartford
Loy & Nawrath Co., N. Y.
Rowbottom Mach. Co., Waterbury
Stoll Co., D. H., Buffalo
Toledo Mach. & Tool Co., Toledo
V. & O. Press Co., Glendale, N. Y.

Presses, Screw
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn

Profiling Machines
Becker Milling Mch. Co., Hyde Park
Garvin Mach. Co., N. Y.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Philadelphia
Pratt & Whitney Co., Hartford
Stark Tool Co., Waltham
Wade-American Tool Co., Waltham

Pullers, Wheel
Crane Puller Co., Arlington

Pulley Turning and Boring Machines
American Tool Works Co., Cincinnati

Pulleys, Cork Insert
American Pulley Co., Philadelphia

Pulleys, Metal
American Pulley Co., Philadelphia
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son Co., H. W., Chicago
Johnson Mach. Co., Carlyle, Manchester
Jones Fdry. & Mch. Co., W. A., Chicago

Pumps, Hydraulic
Burroughs Co., Newark
Elmes Eng. Wks., Chas. F., Chicago

Pumps, Lubricant and Oil
Brown & Sharpe Mfg. Co., Providence
Oilgear Co., Milwaukee

Pumps, Power
Sullivan Machy. Co., Chicago

Punches, Center
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol

Punches, Hand
Armstrong-Blum Mfg. Co., Chicago

Punches, Power
Birdsboro Steel F. & M. Co., Birdsboro
Buffalo Forge Co., Buffalo
Ferracute Machine Co., Bridgeton
Long & Allstatter Co., Hamilton
Mitts & Merrill, Saginaw
Royersford F. & M. Co., Royersford
Ryerson & Son, Jos. T., Chicago
Watson-Stillman Co., N. Y.

Pyrometers, Electric
Bristol Co., Waterbury
Brown Inst. Co., Philadelphia

Rack Cutting Machines
Newark Gear Cut. Mch. Co., Newark

Racks, Cut
Moltrup Steel Products Co., Beaver Falls

Racks, Machine
Standard Gauge Steel Co., Beaver Falls

Racks, Storage (See Furniture, Machine Shop)

Radiators, Japanning Oven
American Gas Furnace Co., Elizabeth

Rammers Foundry
Brown & Sharpe Mfg. Co., Providence
Chicago Pneumatic Tool Co., N. Y.

Rawhide, Rope
Schieren Co., Chas. A., N. Y.

Reamer, Holders
Gisholt Mach. Co., Madison
Victor Tool Co., Waynesboro

Reamers, Adjustable
Davis Boring Tool Co., St. Louis
Hannifin Mfg. Co., Chicago
Whitman & Barnes Mfg. Co., Akron

Reamers, Expanding
Brubaker & Bros. Co., W. L., N. Y.
Davis Boring Tool Co., St. Louis
Gisholt Mach. Co., Madison
Greenfield Tap & Die Corp., Greenfield
McCrosky Tool Corp., Meadville

Reamers, Solid
Brubaker & Bros. Co., W. L., N. Y.
Buckeye Twist Drill Co., Alliance
Butterfield & Co., Derby Line
Gammon-Holman Co., Manchester
Greenfield Tap & Die Corp., Greenfield
Morse Twist D. & M. Co., New Bedford
National Tool Co., Cleveland
National Twist D. & T. Co., Detroit
Reed Mfg. Co., Erie
Union Twist Drill Co., Athol
Western T. & Mfg. Co., Springfield, O.
Whitman & Barnes Mfg. Co., Akron

Reamers, Spiral Expansion
Kruce, E. J., Detroit

Reamers, Taper
Brown & Sharpe Mfg. Co., Providence
Gammon-Holman Co., Manchester
Greenfield Tap & Die Corp., Greenfield
Union Twist Drill Co., Athol
Whitman & Barnes Mfg. Co., Akron

Recorders, Pressure
Bristol Co., Waterbury
Brown Inst. Co., Philadelphia

Recorders, Temperature
Bristol Co., Waterbury

Recorders, Time
Gisholt Mach. Co., Madison

Rheostats
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Rivet-Heating
American Gas Furnace Co., Elizabeth
Kobert Machine Co., N. Y.

Rivet-Making Machinery
Cook Co., Asa S., Hartford
National Machinery Co., Tiffin

Rivet Sets
Chicago Pneumatic Tool Co., N. Y.
Hunter Saw & Mch. Co., Pittsburgh

Riveting Machines
Birdsboro Steel F. & M. Co., Birdsboro
Chicago Pneumatic Tool Co., N. Y.
Grant Mfg. & Mch. Co., Bridgeport
Kobert Machine Co., N. Y.
Ryerson & Son, Jos. T., Chicago
Shuster Co., F. B., New Haven
Townsend Mfg. Co., H. P., Hartford

Rod Cutters and Shears, Hand
Tucker, W. A. & C. F., Hartford

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Gilson Slide Rule Co., Niles

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Lufkin Rule Co., Saginaw
Starrett Co., L. S., Athol

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Chicago Pneumatic Tool Co., N. Y.

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Taylor-Shantz Co., Rochester
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Hunter Saw & Mach. Co., Pittsburgh
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Silver Mfg. Co., Salem

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Diamond Saw & S. Wks., Buffalo
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Racine Tool & Mch. Co., Racine
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Diamond Saw & S. Wks., Buffalo
Peerless Mach Co., Racine
Racine Tool & Mch. Co., Racine
Thompson & Son Co., Hy. G., New Haven
Victor Saw Works, Middletown
Western T. & Mfg. Co., Springfield, O.

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Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Hunter Saw & Mach. Co., Pittsburgh
Huther Bros. Saw Mfg. Co., Rochester
Napier Saw Wks., Springfield, Mass.
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Pratt & Whitney Co., Hartford
Racine Tool & Mch. Co., Racine
Silver Mfg. Co., Salem
Union Twist Drill Co., Philadelphia

Saws, Milling
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
National Tool Co., Cleveland
Union Twist Drill Co., Athol

Saws, Screw Slotting
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney Co., Hartford
Starrett Co., L. S., Athol
Union Twist Drill Co., Athol

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Cook Co., Asa S., Hartford
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Cincinnati (O.) Auto. Mach. Co.
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Brown & Sharpe Mfg. Co., Providence
Cleveland (O) Auto Mch. Co.
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Garvin Mach. Co., N. Y.
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Butterfield & Co., Derby Line
Card Mfg. Co., S. W., Mansfield
Greenfield Tap & Die Corp., Greenfield
Morse Twist D. & M. Co., New Bedford

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Allen Mfg. Co., Hartford
Bristol Co., Waterbury
Hartford Mch. Screw Co., Hartford
National Acme Co., Cleveland

Screws, Machine
Allen Mfg. Co., Hartford
Bristol Co., Waterbury

Screws, Safety Set (See Screws, Cap and Set)

Seamless Tubing. (See Tubing, Seamless Steel)
Wardwell Mfg. Co., Cleveland

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Botwinik Bros., New Haven
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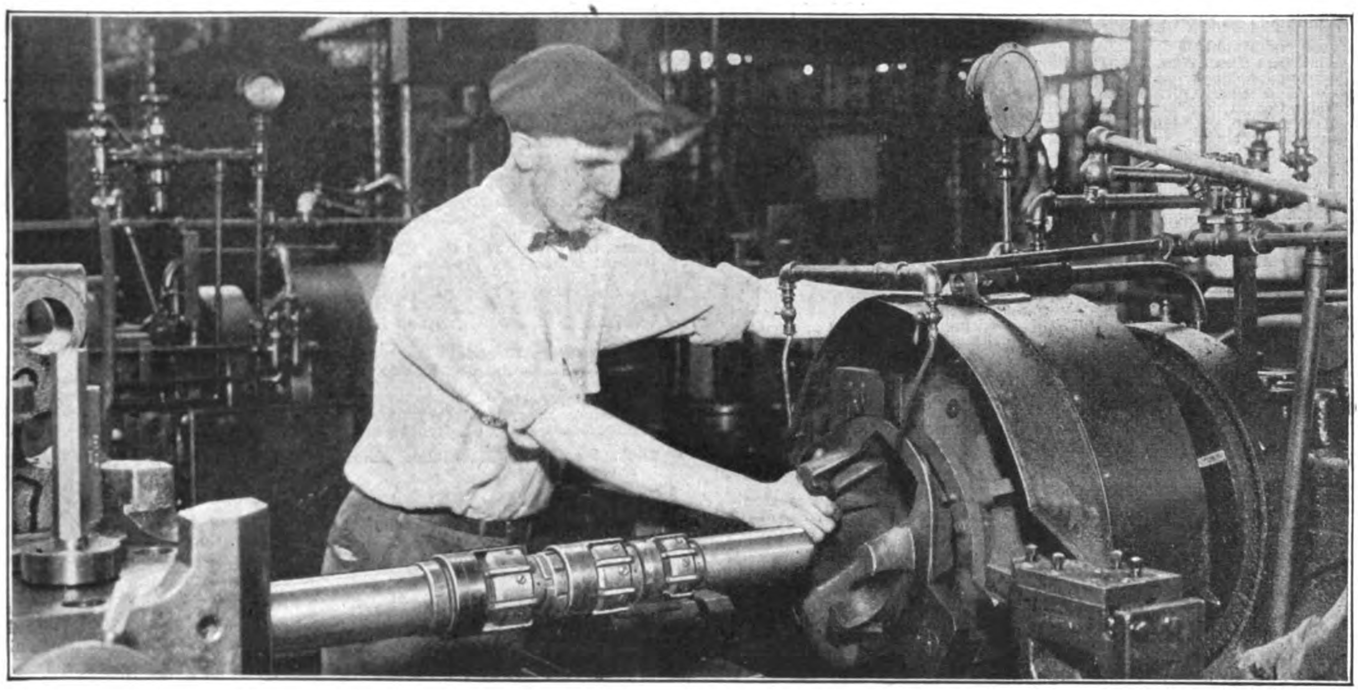


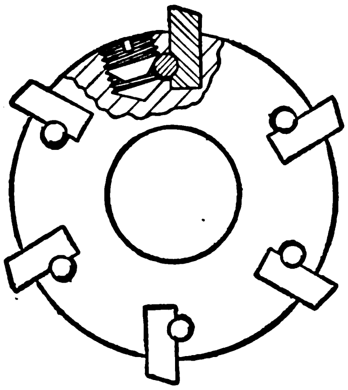
McCrosky—Super Adjustable Reamers

are built according to a superior design that gives unequalled simplicity and rigidity. The accompanying line drawing explains its advantages quickly and clearly. We are not, however, content with merely explaining to you the scientific correctness of the design. We want to prove to you the superiority of the McCrosky-Super by showing you the results it produces in actual operation. When you see it in successful operation, you *know* it is right.

FOR LINE REAMING

The McCrosky-Super installation shown above is operating in the plant of the Canadian Products Company, Walkerville, Ont. These three reamers are 3 15/16 in. 3 5/8 in., and 3 3/32 in. respectively in diameter. They are used to ream differential carriers of Canadian Buick automobiles. The material is malleable iron. This installation illustrates the superiority of the McCrosky-Super for line reaming. The hole of the McCrosky-Super shell type reamer can be made very large without lessening its sturdiness in the least. The big hole permits the using of a large, rigid reaming bar such as is used here. This insures accurately reamed holes within a close tolerance. That is exactly what the Canadian Products Company and many other plants and shops are securing with McCrosky-Supers on line reaming jobs.

McCrosky-Super Design



This cross-section shows the patented locking device that makes the assembled Super practically a solid reamer. Each blade is held in place by a locking key of drill rod embedded partly in the blade and partly in the reamer body. Each key is gripped by a hardened headless set screw that cannot break and that gives the key perfect contact the entire length of the blade groove. The blades adjust forward and, therefore, never lose their bottoming feature.

What is your particular reaming job? We will gladly give you full information concerning the particular size and style of the McCrosky-Super that successful operation in other prominent plants have proved best for it. Write today.

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Murchey Mch. & Tool Co., Detroit
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Errington Mech. Laboratory, N. Y.
Geometric Tool Co., New Haven
Murchey Mch. & Tool Co., Detroit
National Acme Co., Cleveland
Victor Tool Co., Waynesboro

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Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield
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Landis Mach. Co., Waynesboro
Murchey Mch. & Tool Co., Detroit
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Victor Tool Co., Waynesboro

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Geometric Tool Co., New Haven
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Armstrong Bros. Tool Co., Chicago
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Tubing Seamless
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Brown Engineering Co., Reading
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Vises, Metal Workers'
Athol Mach. & Fdry. Co., Athol
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Yost Mfg. Co., Meadville

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Yost Mfg. Co., Meadville

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Federal Mach. & Welder Co., Warren
General Electric, Schenectady
Thomson Elec. Welding Co., Lynn
Thomson Spot Welder Co., Lynn
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Imperial Brass Mfg. Co., Chicago

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Simplex Wire & Cable Co., Boston

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Trimont Mfg. Co., Roxbury
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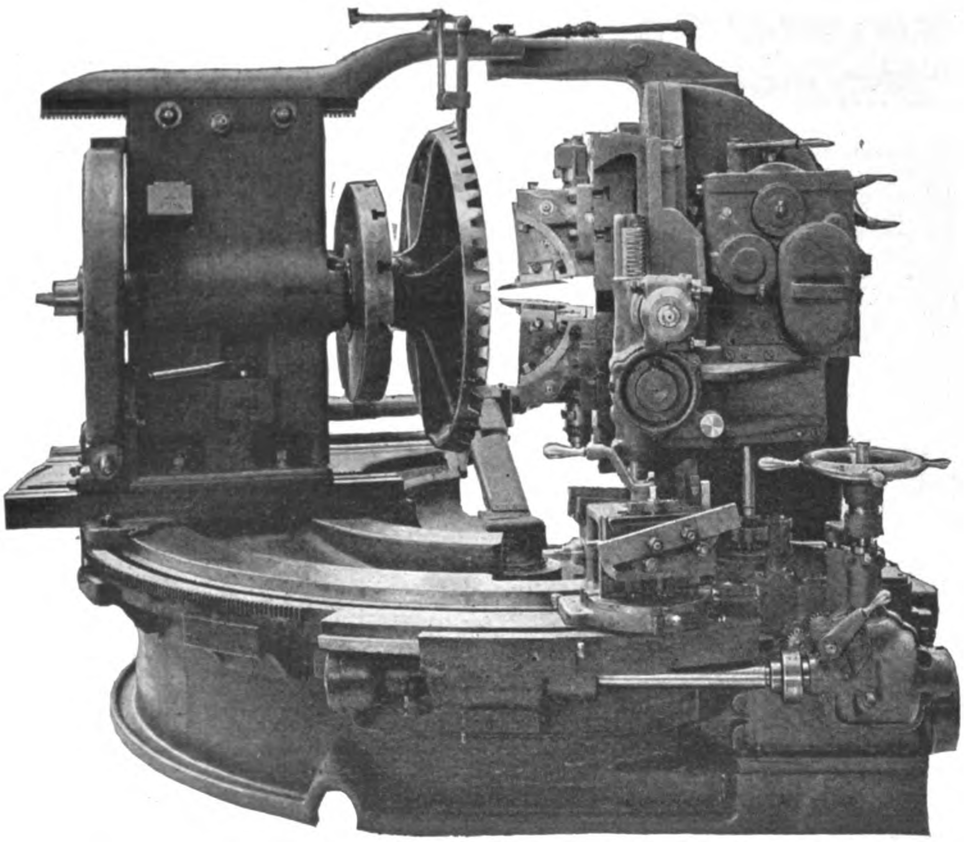
Gleason Two Tool 38 in. Bevel Gear Planer

This recent Gleason design is a general purpose machine employing the advantages of the two tool method of cutting in the field of large bevel gears.

The resulting high rate of production is combined with the usual high quality obtained on Gleason machines.



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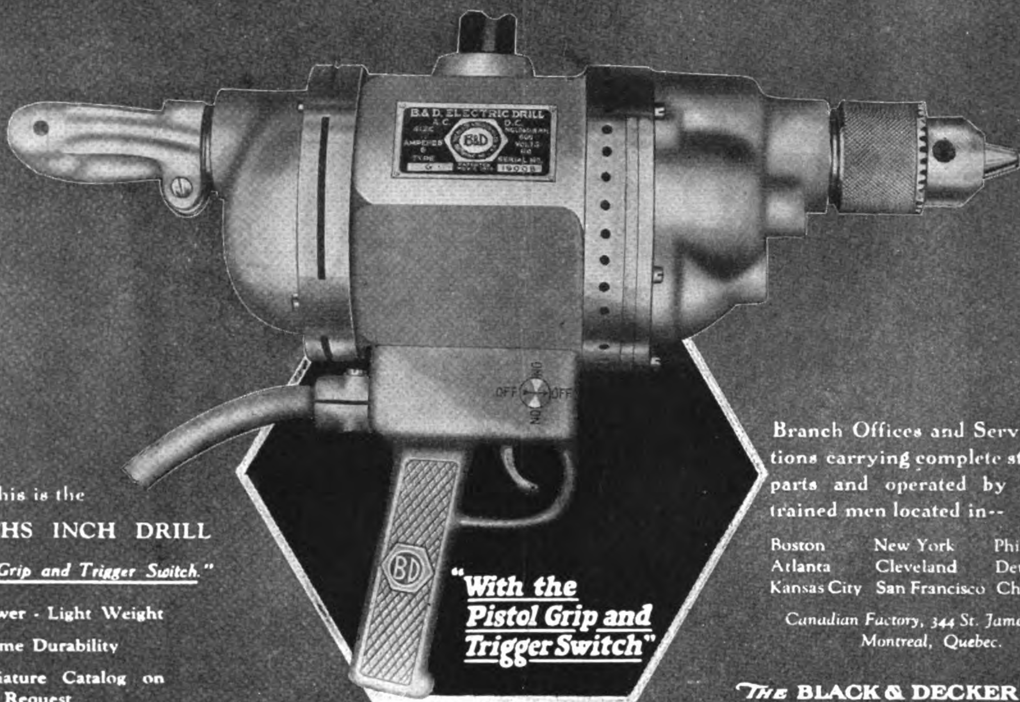

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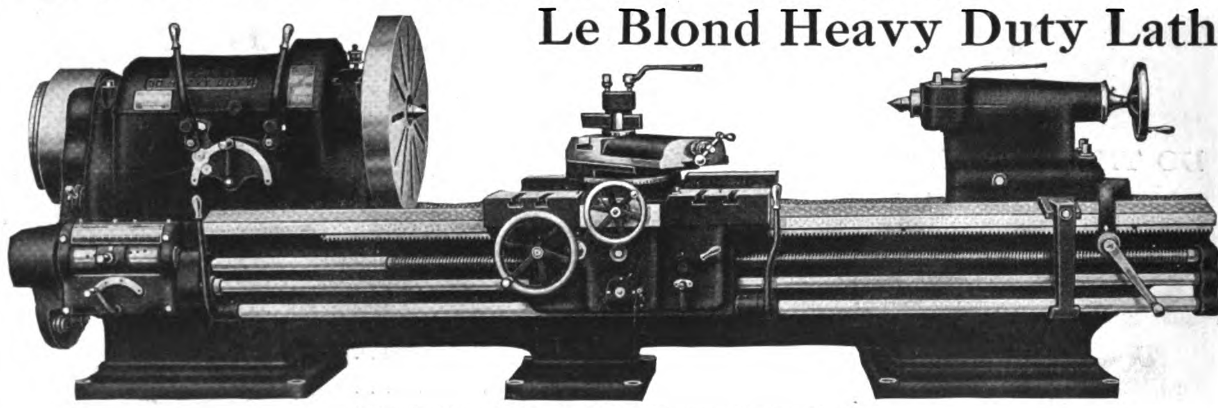


30-inch Geared Head, Quick Change Engine Lathe

A ONE-PIECE BOX SECTION APRON, with positive jaw clutch and all gears (7 in number) drop forged and heat-treated, and with a rack pinion of chrome nickel steel, heat-treated and hardened.

A BED designed with broader bearing surface, a special section which AUTOMATICALLY compensates for wear, and POSITIVELY PREVENTS carriage climbing.

A higher standard of workmanship—the strictest inspection and the determination to produce lathes of greater power, rigidity and convenience than any other lathe built for similar service.

May we send our descriptive Catalog?

The R.K.Le Blond Machine Tool Co.
Cincinnati.Ohio.

American Machinist

McGraw-Hill Company, Inc. New York 25 cents a copy

A Message for 1923

IN ACCORDANCE with our usual custom we are using the cover of our last issue of the year to extend to our friends of the machinery industry our heartiest good wishes. We want every one of you to get our message. Hence the use of the most powerful broadcasting station in the industry.

While 1922 has been a keen disappointment in many respects, we believe that in 1923 a substantial start will be made in solving the world problems that have confronted the human race since the close of the World War in 1918. Nearly every one now recognizes that the Allies were more successful at making war than they have been at making peace. In other words, the armies were more efficient than the statesmanship that followed.

Perhaps we may suggest the answer. The men of the great armies were filled with a wonderful spirit of self-sacrifice that overcame seemingly insuperable obstacles. The French at Verdun, the British at Ypres and the Americans at Chateau Thierry rose to heights that are seldom equaled. They lost all thought of self and gave all they had to a cause. Their sacrifice was not in vain.

THE Armistice ended the fighting but at the same time it seemed to snuff out the spirit of co-operation and unselfishness that won the war. Petty bickerings broke out and old-fashioned diplomacy regained control.

The war disturbed and unsettled all existing economic conditions throughout the world. Followed by the lack of an adequate peace it resulted in untold suffering and misery which has been beyond the power of statesmen to control. Nations as well as individuals have been dominated by greed and selfishness until civilization has reached the brink of oblivion.

Hatred and overzealous nationalism have failed to solve the problems of the world. They must be replaced by the greater love, gratitude, loyalty to principle, kindness and forebearance which were so evident during the war. If the peace is to be won as was the war it must be approached in the same high spirit.

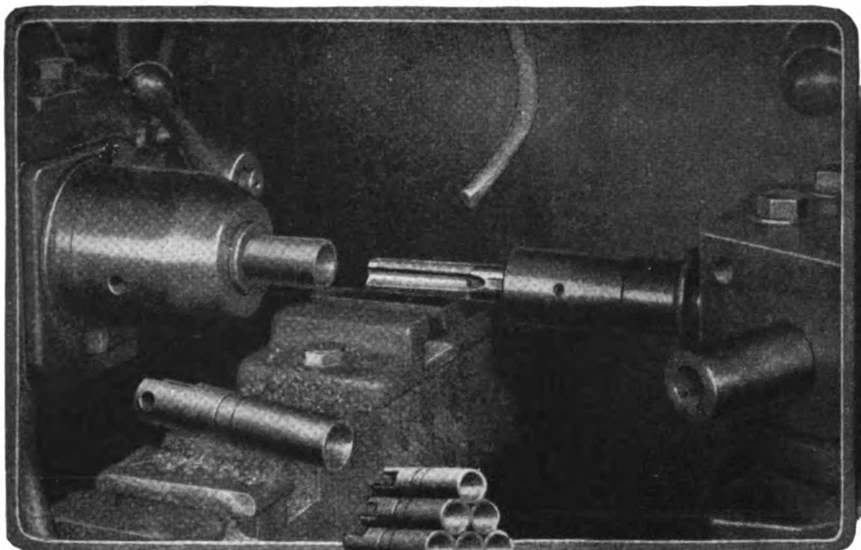
PRESENT signs indicate the coming of a reawakening throughout the world. The American people are beginning to realize that co-operation with the nations of Europe is the big task ahead of them, a moral obligation that must be met and incidentally a prerequisite to full prosperity. Under the leadership of the United States Government, 1923, let us hope, will be a year of fulfillment.

As the world prospers so will the United States. And with general prosperity will come success for the men who make and use machinery. To these men we make our appeal. Let us all get together for a co-ordinated effort to gain happiness and prosperity for the world, our country and ourselves.

Let's make 1923 a happier and more prosperous year than any that have gone before.

American Machinist

December 28, 1922



Meeting the Test

THE valve lifters of a well-known truck are tapped in cold rolled steel with a 13/16-20 U. S. F. Pratt & Whitney Con-eccentrically Relieved Tap.

After careful testing, this style and make of tap was selected for its ability to stand up under high production and has proven satisfactory for over two years. The durability of these tools comes from the careful selection and heat treatment of the steel, while their cutting qualities are assured by their construction and the care taken in the manufacturing processes.

The con-eccentric feature insures the retention of original size through a number of regrindings. Instead of relieving the tooth directly back from the cutting edge, the land is made concentric for one third of its width, the remaining two thirds being eccentrically relieved.

You make no mistake in specifying P. & W. Taps for ordinary work or for exceptional jobs such as the one illustrated.

Taps, Dies, Reamers, Milling Cutters and many other tools are listed in our small tool catalog. A copy awaits your request.

PRATT & WHITNEY CO.

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General Offices: 111 Broadway, New York

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PRATT HITNEY

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American Machinist

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Coming Features

Management of the Machine Jobbing Shop
Organization and Management of a Medium Sized Plant
What's Wrong With the Railroad Shops?
And Other Management Articles

In the first issue of 1923

JAMES H. McGRAW, President — ARTHUR J. BALDWIN, Vice-President — MALCOLM MUIR, Vice-President — EDWARD D. CONKLIN, Vice-President — JAMES H. McGRAW, JR., Secretary and Treasurer

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Ideals *plus* Ideas

TIME-HONORED custom makes this the open season for new resolutions, when each of us is wont to set a higher goal for next year's achievement.

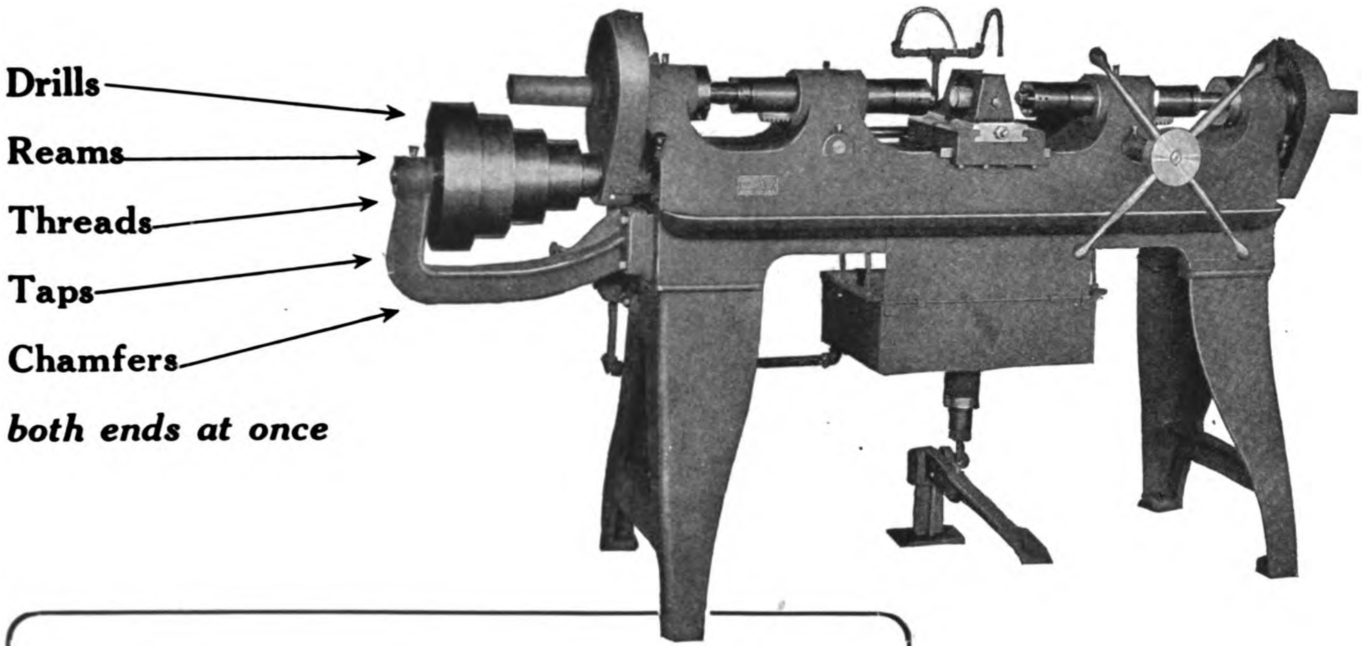
But a new leaf thus blithely turned over has one fatal fault—it *doesn't always stick*. New Year's ideals, if not sustained by IDEAS, fade soon into the mist of the might-have-beens.

IDEAS—new ideas, better ideas and proved ideas—a wealth of ideas that will help readers of the *American Machinist* carry out their New Year's Ideals—are found each week in the advertising pages of the *American Machinist.*

IDEAS for the executives in every part of the metal-working manufacturing shop—facts about materials and equipment that will make a better product at a lower price—are waiting to be gleaned from the Buying Section. Here machinery executives who have resolved to raise production standards and reduce costs will get the essence of up-to-date practice—for the fact that a method or machine is advertised consistently is the best proof that it has made good.

So, after you have made your New Year's resolutions, make just one more in order to make the other ones stick. Resolve to make full use of the advertising pages of the *American Machinist,* where dependable ideas, proved and vouched for, are yours for the reading—because

Only Reliable Products
can be Continuously Advertised



Multi purpose machines are an asset these days

Competition of the kind to be met in manufacturing today demands that the cost of production be the minimum possible.

In attaining this objective multi-purpose machines are not only an asset but an actual necessity.

When you can get a machine that will perform any one or all of the five operations mentioned above more cheaply and in some cases better than the single-purpose machines that are necessary to do the same work, there should be no hesitation whatever in installing the machine.

Such a machine is the Murchey Double End Machine. And it is particularly productive where any or all of these operations are performed on both ends of the work, for it is arranged to complete both ends simultaneously.

No machine you can install today offers you a greater opportunity to cut down manufacturing time and costs than does this New Murchey Double End Tool.

If you will send us samples of parts or prints we will give you cost and production estimates to prove it.

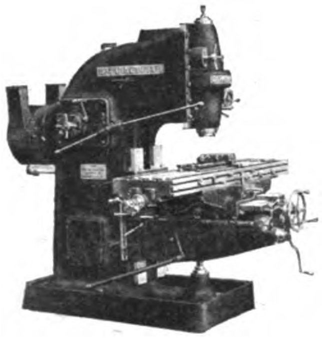
Murchey Machine & Tool Co.

953 Porter St., Detroit, Mich., U. S. A.

Cleveland Office, 6523 Euclid Avenue; Pittsburgh Representatives, Laughlin & Barney, Union Arcade Bldg.; Chicago Representatives, R. E. Ellis Engineering Co., 621 Washington Blvd.; Los Angeles Representatives, Smith-Booth-Usher Co., 228 Central Ave.; San Francisco, Smith-Booth-Usher Co., 50-60 Fremont St.; Coats Machine Tool Co., 14 Palmer St., Westminster, London, S. W., England; Fenwick, Freres & Company, 8 Rue de Rocroy, Paris.

MURCHEY Double End Machine

OUR WELCOME



Cincinnati No. 4 Vertical High Power Miller. One of 38 Types and Sizes of our Millers.

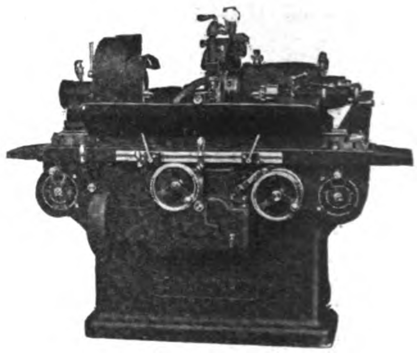
Upon Coming to Cincinnati You Will See In Our Plant

Modern Buildings
Machine Shop equipped for refinements in manufacturing.
Large Engineering and Design Dept.
Machine equipped Foundry with thoroughly tooled Pattern Shop.
Physical and Chemical Laboratories.
Tool Room with modern layout.
Centralized Tool Stores.
Precision Tools and Gauges.
Demonstration Room.
Complete line of our products in a running exhibit.
Operators' Instruction Sheets.

An Employees' Service Department with Modern Employment Methods

Careful Medical and Surgical Attendance for employees.
Sanitary and Safety Provisions.
Self-Service Dining Hall.
Co-operative Students of the University of Cincinnati at work.

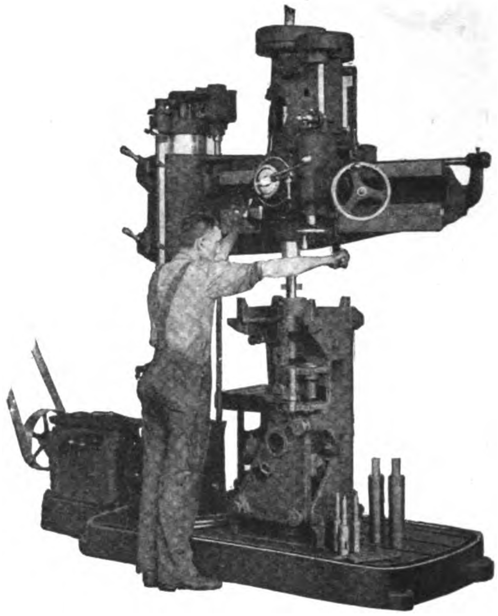
Cincinnati Grinder Company's line of Cylindrical Grinders; in the process of manufacture and in demonstration.



12" x 24" Plain Cincinnati Cylindrical Grinder.

THE CINCINNATI GRINDER COMPANY

THE CINCINNATI BICKFORD



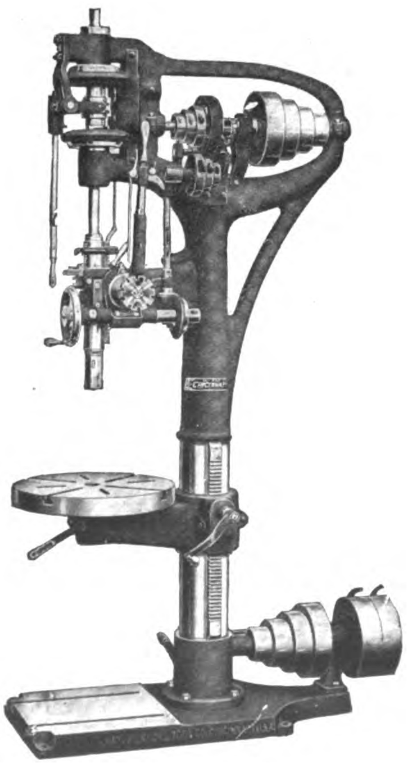
4, 5 and 6 Foot Regular Plain Radial

One of the many highly desirable features of this machine is the location of its control levers. Maximum efficiency is unattainable without maximum convenience of operation. No back gears can be engaged without shock while the spindle is revolving at high speed. The driving clutch must be released sufficiently to permit slippage while the change is effected. The back gear lever should, therefore, be placed within easy reach of the reverse lever, so that the operator can keep a hand on each as depicted opposite.

The Cincinnati Bickford Tool Co.

Oakley, Cincinnati, Ohio, U. S. A.

Founded 1874



THE CINCINNATI

21-Inch Stationary Head Upright Drilling Machine

This illustration depicts the drill equipped with Back Gearing, Power Feed and Patented Tapping Attachment. The Back Gears increase the number of speeds from four to eight and multiply the pulling power of the spindle nearly five and one-half times. The tapping attachment acts through friction clutches and hence enables the operator to stop, start and reverse the spindle while the machine is running.

MILWAUKEE MILLING MACHINES

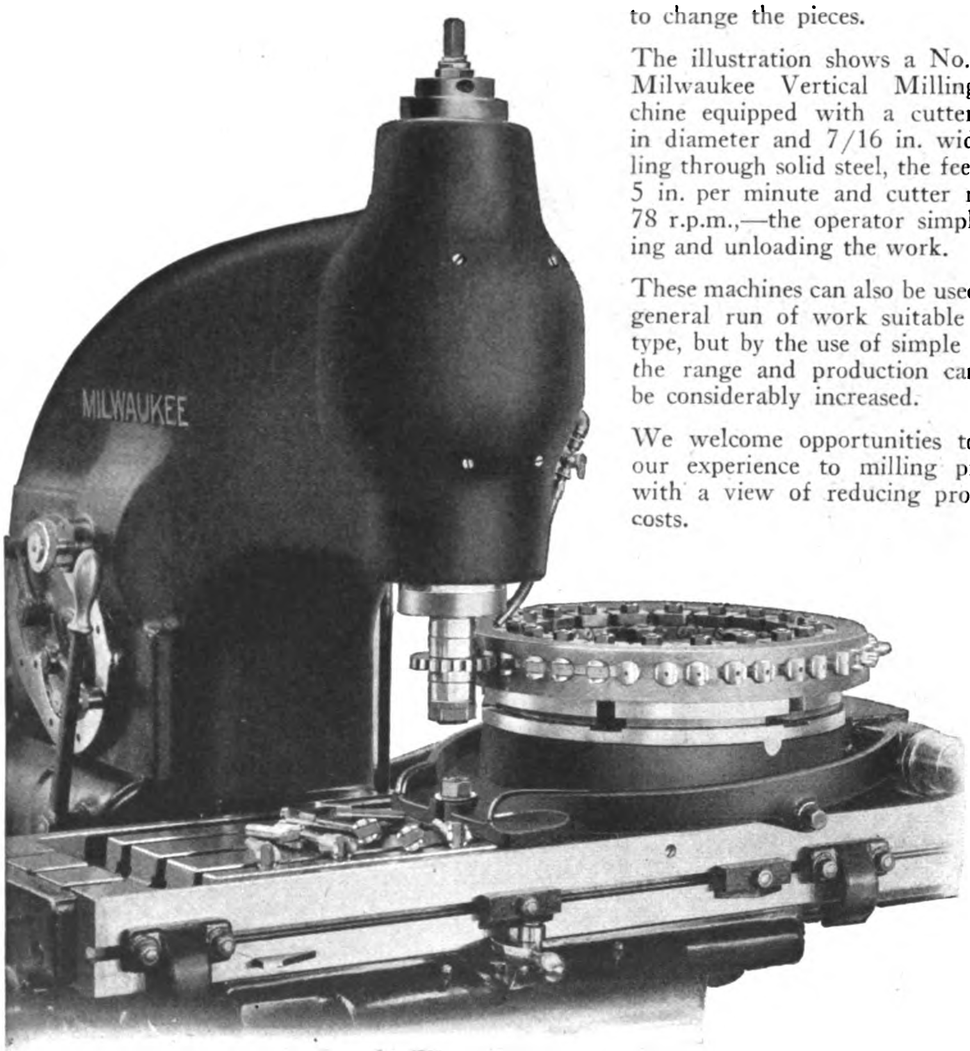
Continuous Milling on a Milwaukee Vertical

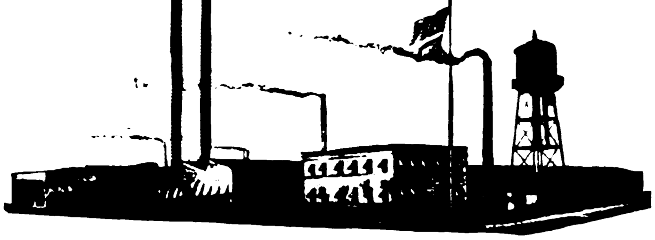
Milwaukee Vertical Milling Machines are well adapted for rapidly producing many parts by the continuous milling process, the limiting factors being the ability of the cutter to remove the stock and the operator to change the pieces.

The illustration shows a No. 1½-B Milwaukee Vertical Milling Machine equipped with a cutter 4 in. in diameter and 7/16 in. wide, milling through solid steel, the feed being 5 in. per minute and cutter running 78 r.p.m.,—the operator simply loading and unloading the work.

These machines can also be used on the general run of work suitable to this type, but by the use of simple fixtures the range and production can often be considerably increased.

We welcome opportunities to apply our experience to milling problems with a view of reducing production costs.





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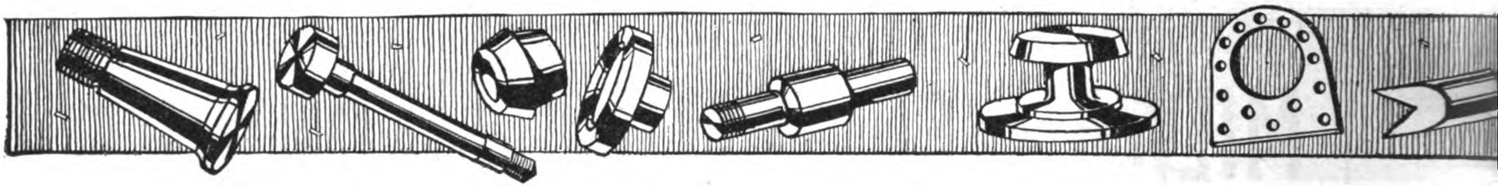
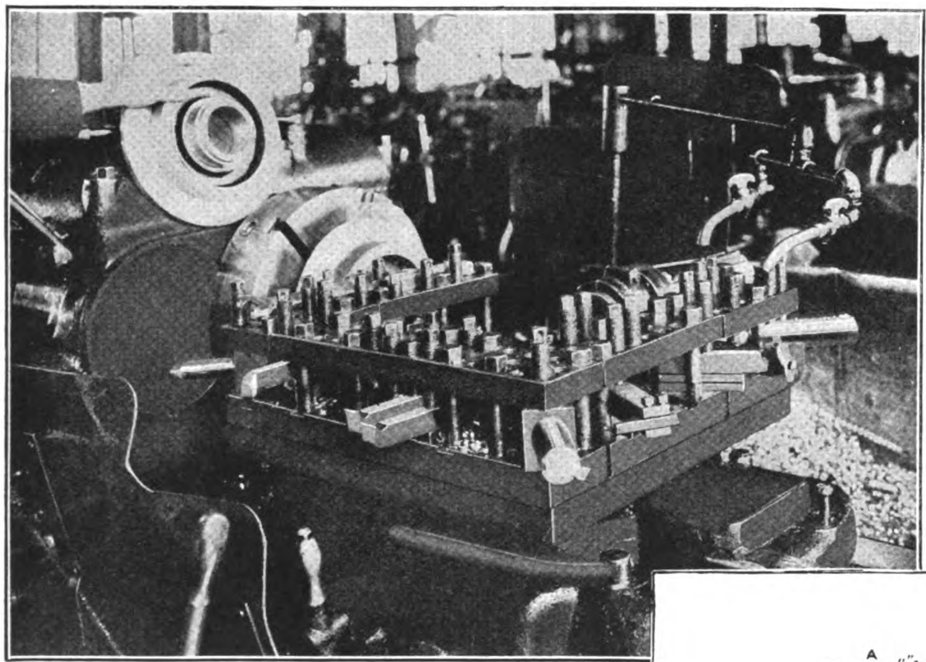


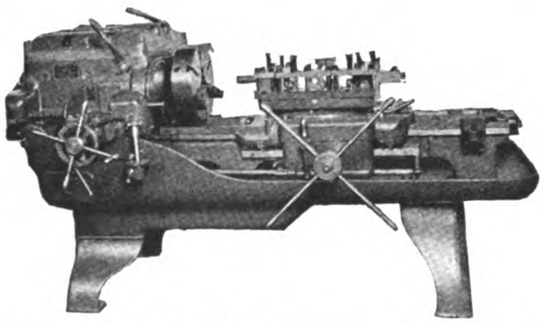
Versatility of the Hart shown by many examp



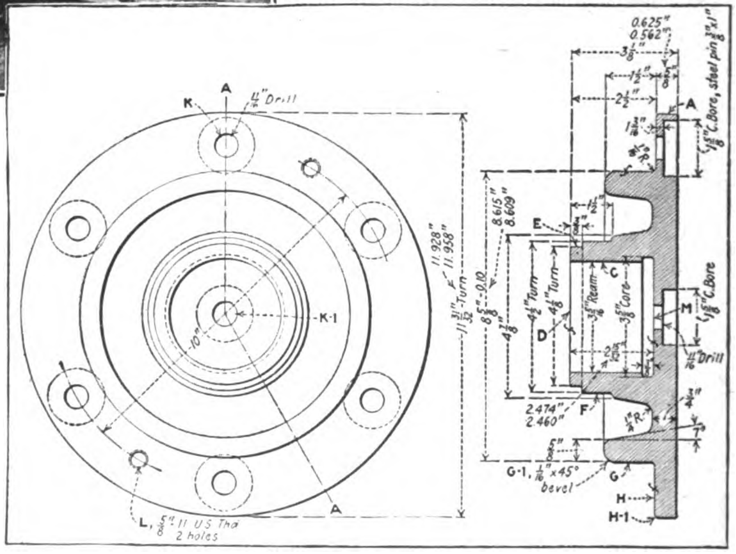
This is one of a series of examples taken from actual practice to illustrate the wide range in character of work of which the Hartness Flat Turret Lathe is capable, and its quick change possibilities from one job to the next. The examples are of parts being made on a commercial basis by a large manufacturer of mining machinery. They have 100 Hartness F. T. Lathes in their plant. Note the tools placed in the corners on this set-up. This gives 8 different positions instead of 4.

Operations on this piece performed on the Hartness

1. Turn A
2. Drill K-1
3. Rough bore C
4. Rough turn E, F and G
5. Rough face H, D and M
6. Finish bore C
7. Finish turn E, F, G and bevel G-1
8. Finish face H and D and bevel H-1.



Double Spindle HARTNESS Flat Turret Lathe equipped as a single spindle giving a 17 in. swing and 8 positions of turret.



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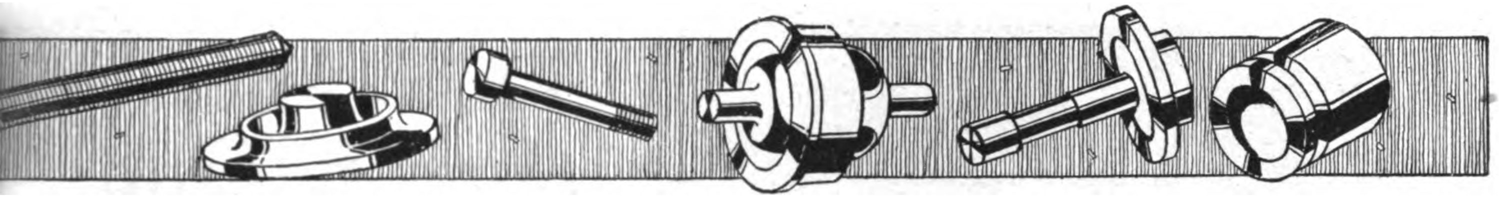

ness Flat Turret Lathe
les from actual practice

If your machines lack adaptability you must run the work through your plant in excessively large lots, or else you must have an unnecessarily large number of machines with, practically all the time, a certain percentage standing idle. This ties up a lot of your money where you derive no benefit from it and is a waste all around.

For quick adaptability to a great variety of jobs the Hartness Flat Turret Lathe is unexcelled. It has many exclusive features that contribute toward this result. Among others is the Cross Sliding Head.

The use of the Cross Sliding Head makes every turret tool a cross slide tool if necessary. The same tool can both bore and face, or turn and face.

The same tool can turn and bore two different diameters.

The same tool, if necessary, can face two different shoulders.

The same tool can feed forward or backward.

Nine stops for the cross sliding head, any or all of which may be applied to any one turret position, add to the flexibility of the general scheme.

The Hartness Flat Turret Lathe is the only lathe having a cross sliding head. All others must resort to a toolpost or to mounting the turret on two slides in order to get the same movements. Hence the "Hartness" is the only turret lathe having length and cross-feeds for each tool without resorting to the double-slide turret support.

This gives to the "Hartness" a versatility and adaptability with tool economy on both bar and chuck work that can not be equalled by any other turret lathe on the market.

Investigate this Hartness F. T. Lathe. It gives the largest output per dollar, as well as a low cost of work and an accurate duplication. Write today for complete details.

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VERMONT

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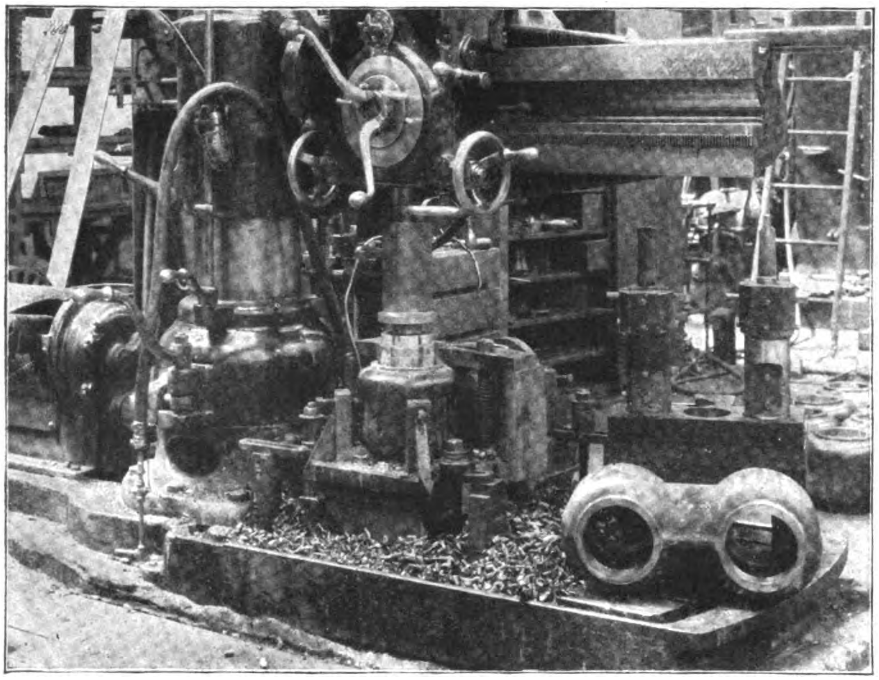
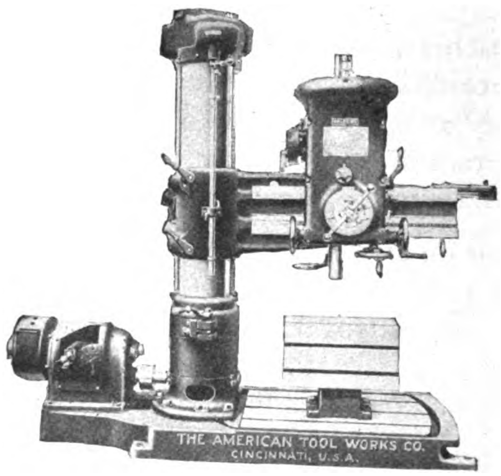


This Shows thing Behind
"DO IT WITH

This 4-foot
AMERICAN



Radial bores, faces and taps 6 in. holes in close-grained steel Time, 57 minutes

Probably there was some doubt as to results when Superintendent J. E. Dykstra, of the Foos Gas Engine Co., Springfield, Ohio, first put this 4-ft. "AMERICAN" Triple Purpose Radial Drill to the test, pictured above.

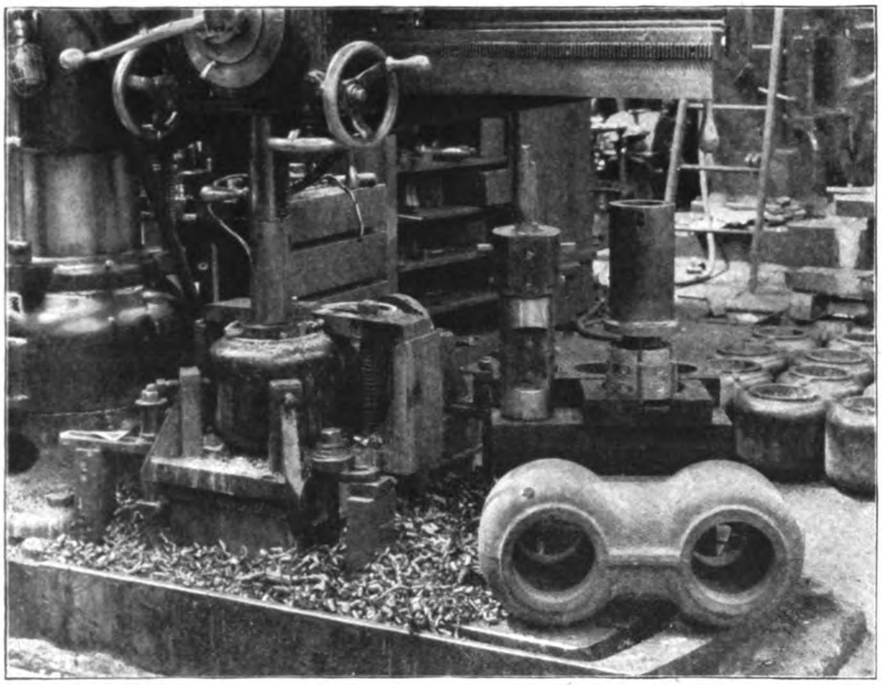
But it didn't take long for the wide-awake production executives in this shop to come to the conclusion that here was still another job where it paid to "do it with an AMERICAN."

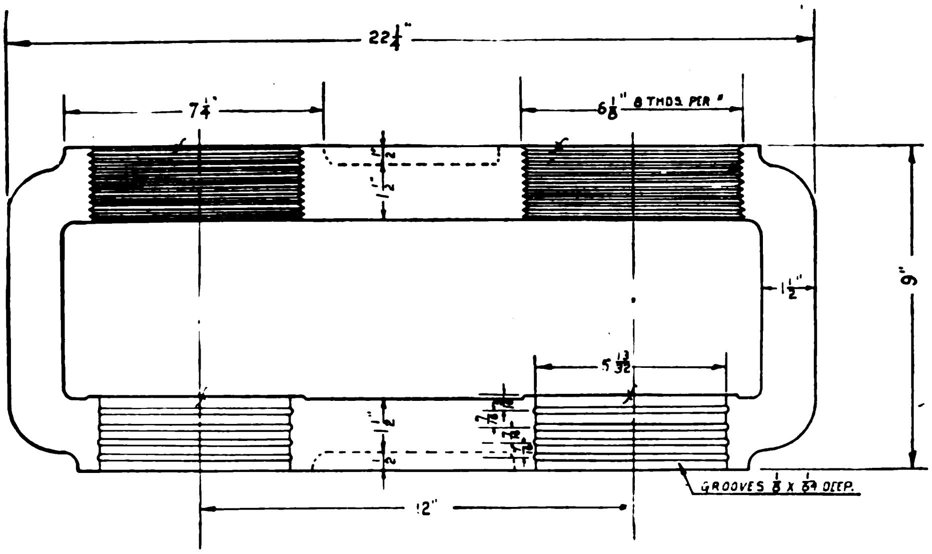
These castings of close-grained steel, capable of resisting a high pressure test, are rough and finished bored, faced and tapped. The production average, floor to floor, for the two 6-in. holes is 57 minutes. The extreme precision and reliability of the sturdy, adaptable "AMERICAN" eliminates spoilage. Out of 250 castings, 3 only were lost—and these due to a dull tap and hard spots in the castings.

THE AMERICAN TOOL WORKS

Lathes *Planers*

There's Some- the Slogan— AN AMERICAN"!





The Secret

of the "American" Triple Purpose Radial Drill's remarkable success on boring and tapping jobs lies primarily in the internal gear spindle drive. The "American" is the only radial drill built that provides this feature, and consequently is pre-eminent on all work of that nature.

With the internal gear drive for boring and tapping, not only is there a smooth rolling contact between the gears, which imparts a smooth, steady action to the spindle, but there are a greater number of teeth in mesh than on the ordinary external gear drive; consequently, the spindle is held much more rigidly against chatter and vibration by the internal gear drive than it could possibly be held by an external drive. On our internal gear spindle drive there are three teeth constantly in mesh, while on the external gear drive, common to other designs, only one tooth is in mesh.

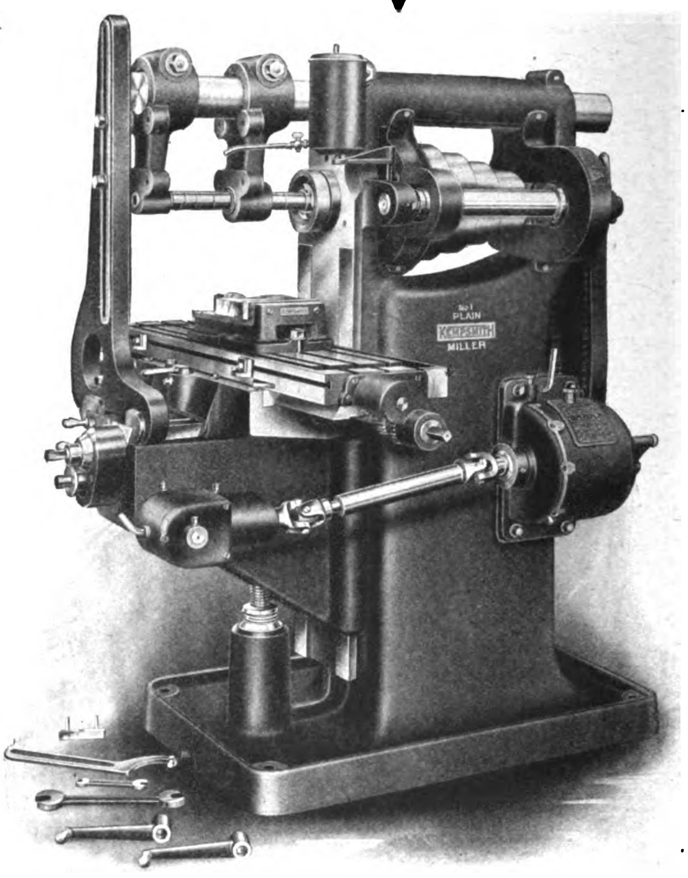
We build Radial Drills in sizes from 2 to 7 feet.

Probably you too can save big money on production by equipping to "Do it with an AMERICAN." At any rate, it's worth investigating. Let us go into the proposition with you.

COMPANY, CINCINNATI, U. S. A.

Shapers ***Radials***

Save Your Original Investment By Buying This



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Their Price is *RIGHT*

KEMPSMITH

THE KEMPSMITH MF'G-CO
MILWAUKEE U S A.

The Maximum in Milling Machines

"tuff stuff"

Here's a job that demands the acme of precision on internal grinding. It is a Universal Joint Body and the material is Hard Steel.

Limits of .001 in. are held to on this piece and the .015-in. stock is removed in finishing. Twenty-five of these bodies are produced hourly. The Universal Products Company, where this work is being done, have 14 Heald Grinders. Such a battery is sufficient evidence of their value as producers, especially on this particular tough material.

Grind with a HEALD and be sure

HEALD

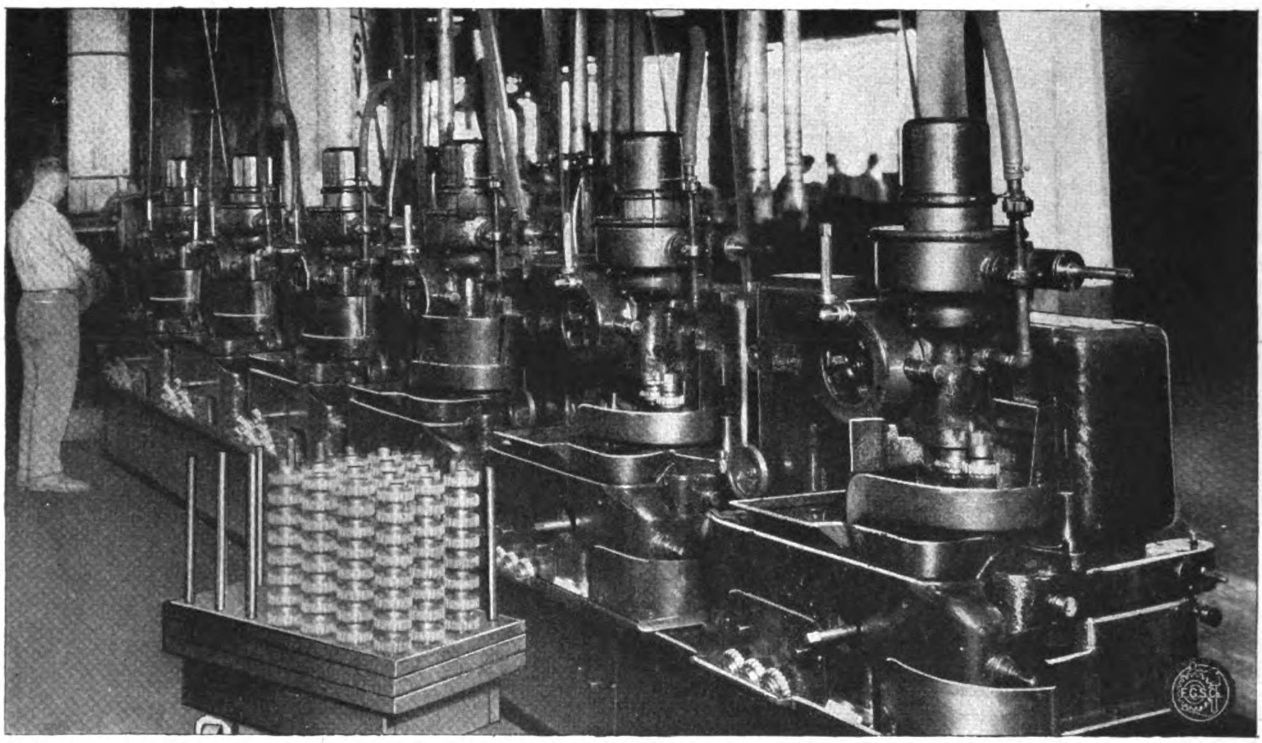
No. 75 Internal Grinder

is extremely rigid, durable and simple in construction. It is easily operated and fully guarded to protect the operator. It is particularly well adapted to handle such work as transmission gears, bevel gears, pinions, bushings, rings, etc., and on this short work will be found fully as rapid as any automatic feed machine.

Let Heald Engineers give you some performance facts and figures

THE HEALD MACHINE COMPANY

35 New Bond St., Worcester, Mass.



The New High-Speed Gear Shaper which is taking the place of Single-purpose Machines in many of the Large Automotive Factories

The Single-Purpose Machine is Taboo

A machine tool designed especially for performing one or more operations on a certain part may produce a greater number of pieces per hour than a so-called standard machine equipped with special fixtures.

But, when a change is made in the design of the part produced, what becomes of the single-purpose machine, unless it can be adapted to the new part?

The new High-speed Gear Shaper is a standard machine having single-purpose possibilities. To handle different pieces of work, it is only necessary to equip it with work arbors or work-holding fixtures suited to the work in hand. The machine in all of its functions and units is a standard product.

Works Managers in general are appreciating the significance of this fact and are adapting standard machines to single-purpose machine work.

Our book, "A New Development in Gear Cutting," explains wherein the new High-Speed Gear Shaper fulfills this important requirement.

Do you want a copy?

The Fellows Gear Shaper Company

Springfield, Vermont, U. S. A.

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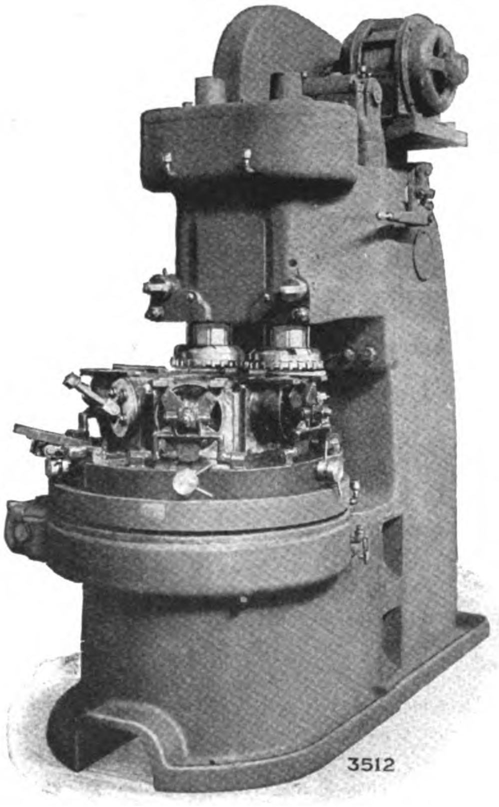
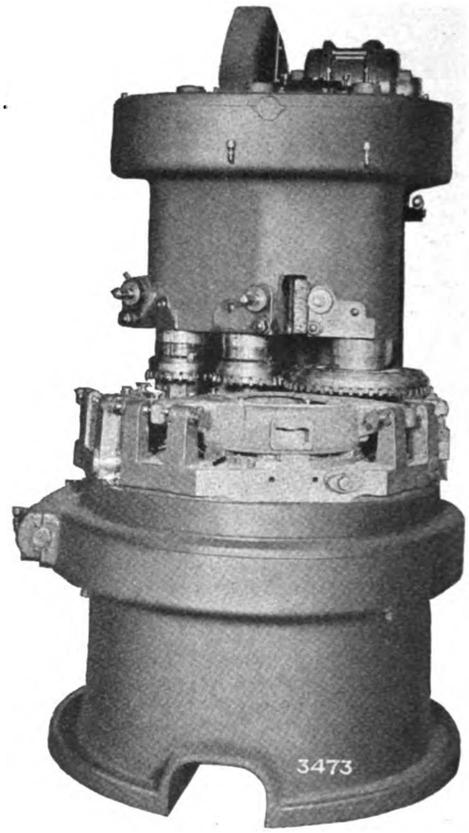
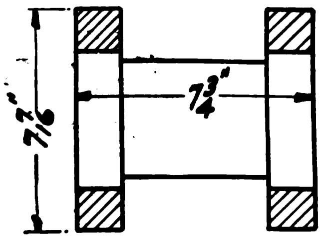
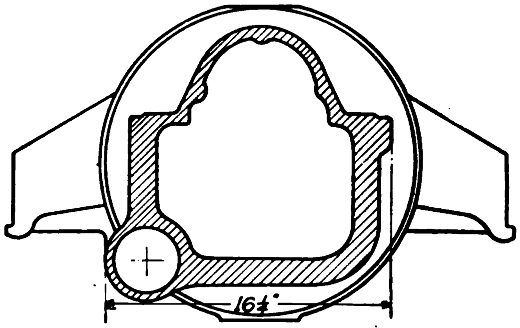
INGERSOLL
Rotary Milling Machines







Milling the feet of General Electric Motor Frames.
A finished casting produced every minute.



Roughing and finishing flywheel housings
for Continental Motors.

The development of the Ingersoll Rotary Continuous Milling Machine can be carried out so as to include a great many castings and forgings where the production requirements warrant continuous milling.

They occupy a very small amount of floor space and require only one operator, who merely removes the finished castings and replaces them with rough ones. This work can be done by one man without undue fatigue because the machine operates continuously, and without requiring his attention.

The cutters and fixtures with which these machines are equipped were designed and built in our shops and the entire responsibility for the installation was assumed by us.

In addition to building special machines adapted only for quantity production, we are prepared to build machines on which a large number of different operations can be performed, for shops having a diversified line of work going through in small quantities.

The Ingersoll Milling Machine Co.

Milling Machines and Their Equipment

Detroit: David Whitney Bldg. ROCKFORD, ILL. 50 Church St., New York

Two Operations at The Same Time

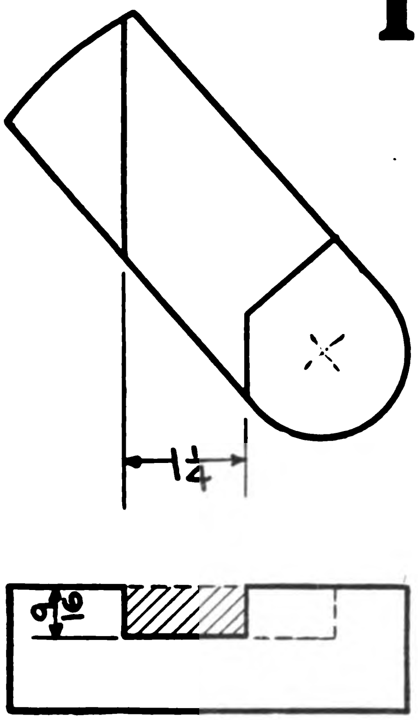


Fig. 1

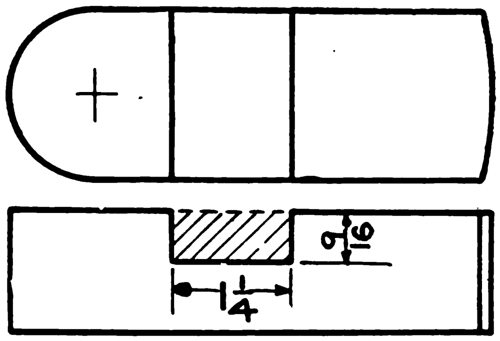
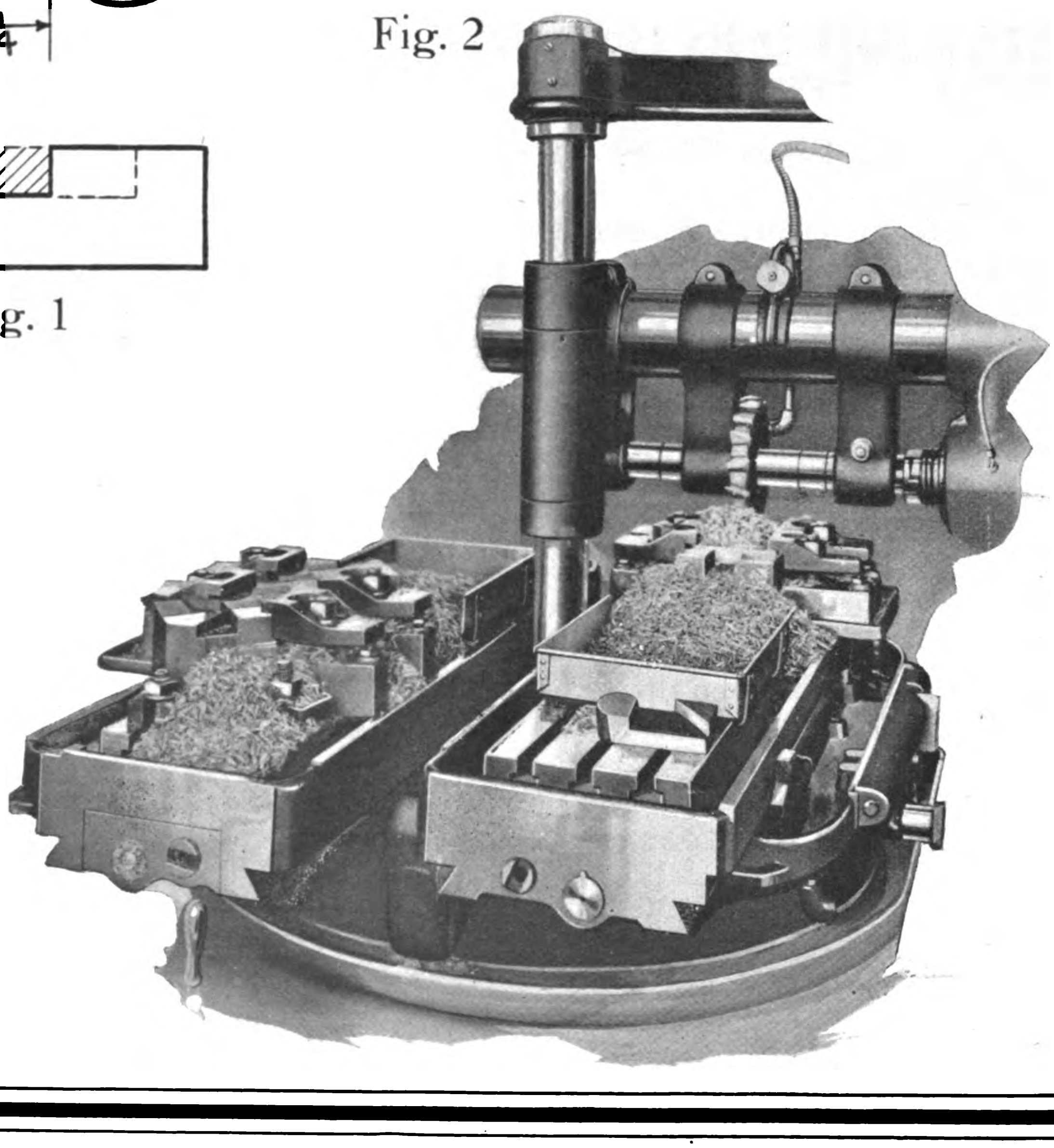
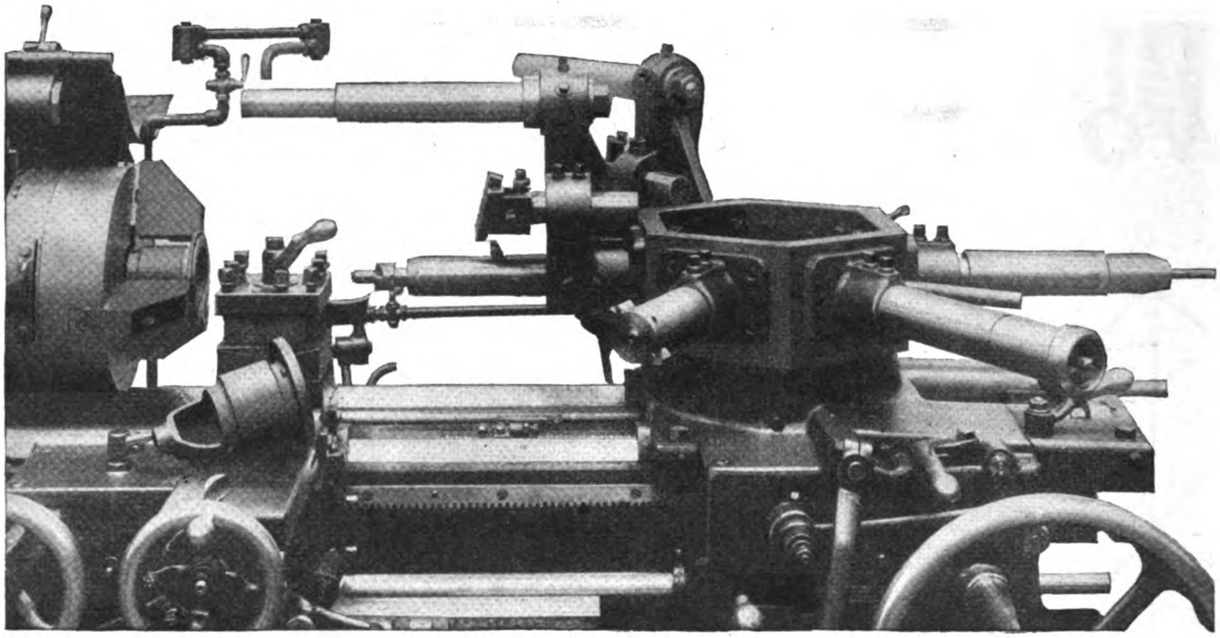


Fig. 2





Bendix Housings Finished in 3 minutes each on a W. & S. Turret Lathe

Overhead piloted tools can very often do your work to better advantage in cost, in accuracy and in finish. W. & S. Engineers recommended them in the job pictured above.

The very close accuracy to be obtained in the finish of these bendix housings demanded the use of this type tool, and the resulting time obtained (3 minutes each) quite justified their cost.

Have you some very accurate work you'd like to speed up? Send us blue prints of it.

Turret Lathes and Turret Lathe Tools $\frac{5}{8}$ in. x 4 in. to $4\frac{1}{2}$ in. x 44 in. Bar Capacity Up to $21\frac{1}{2}$ in. Swing for Chucking Work.

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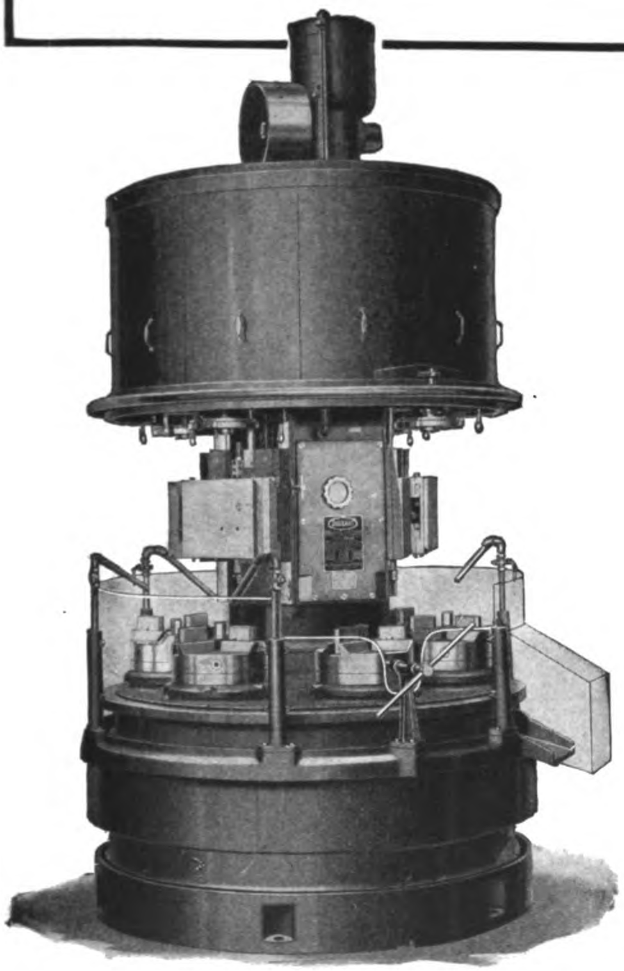
Mechanically Controlled Costs

The exactness of control and the elimination of waste motion insures against loss of machining seconds in the Bullard Mult-Au-Matic. Feeds and speeds are not guessed at. The time between cuts on series operation work is automatically controlled to the minimum.

THE

BULLARD



MULT-AU-MATIC

sets the pace and the operator merely chucks the blanks and removes the finished parts at the loading station. "The longest cut in the shortest time" is standard Mult-Au-Matic practice, so also is "Save all other tools"—for the shorter operations at other stations may be slowed down and the tool life lengthened proportionally.

Our files contain scores of reports showing Mult-Au-Matic savings.

On your chucked work the Mult-Au-Matic will save a large part of your direct and indirect costs. Our Engineering Service is yours to consult. Send us prints or samples of your chucked work for study and estimate.

The Bullard Machine Tool Company

Bridgeport, Conn., U.S.A.

Builders of the Mult-Au-Matic, the Vertical Turret Lathe and the Maxi-Mill.

What every purchasing agent and production engineer should know

about

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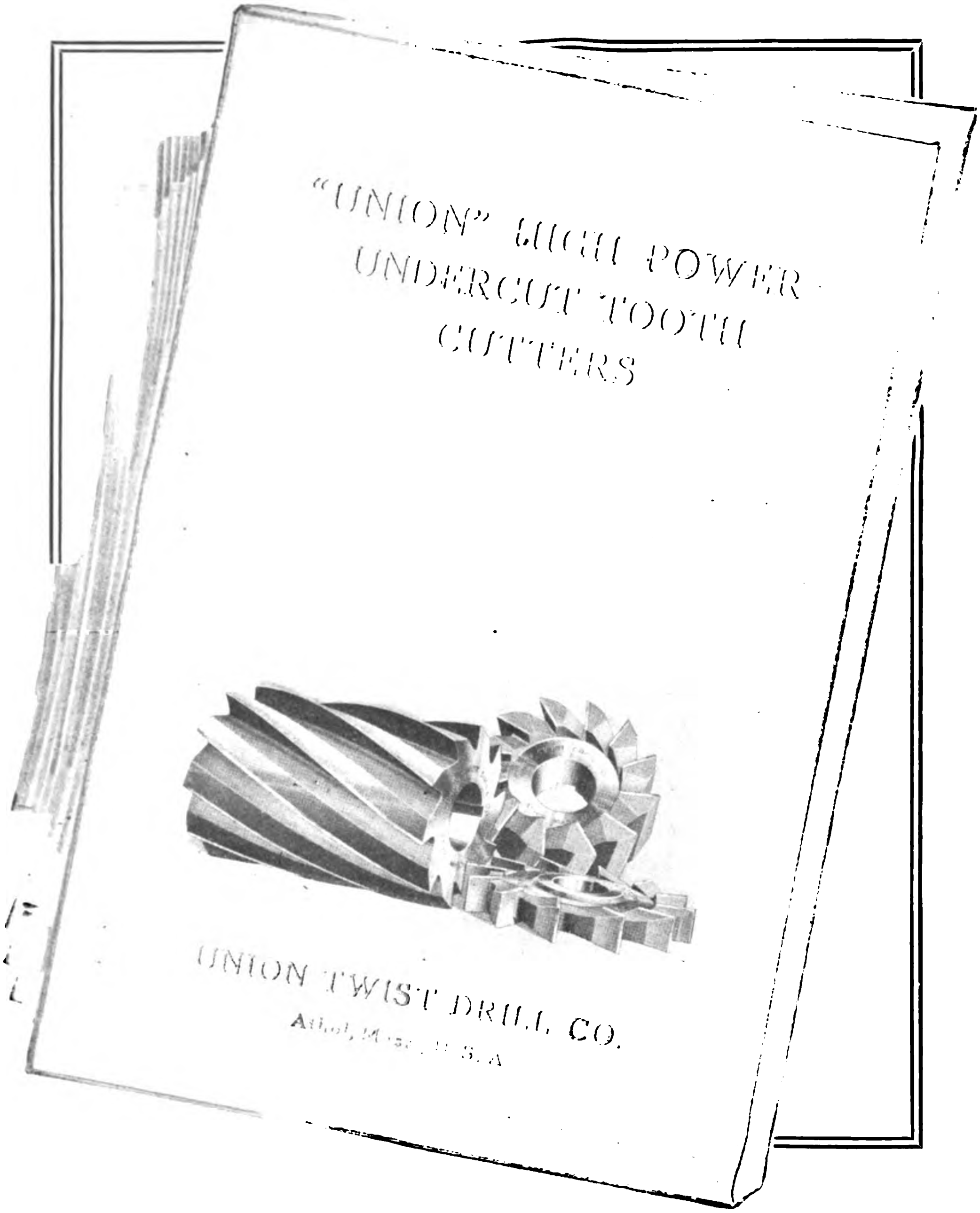
High Power

Cutters



Why they require less driving power.

Why they last longer.

Why they do not get dull as quickly as other cutters.

Why they permit faster feeds.

Why they reduce labor costs.

Why they increase your profits.

All of these reasons, and other valuable data are given in our new bulletin.

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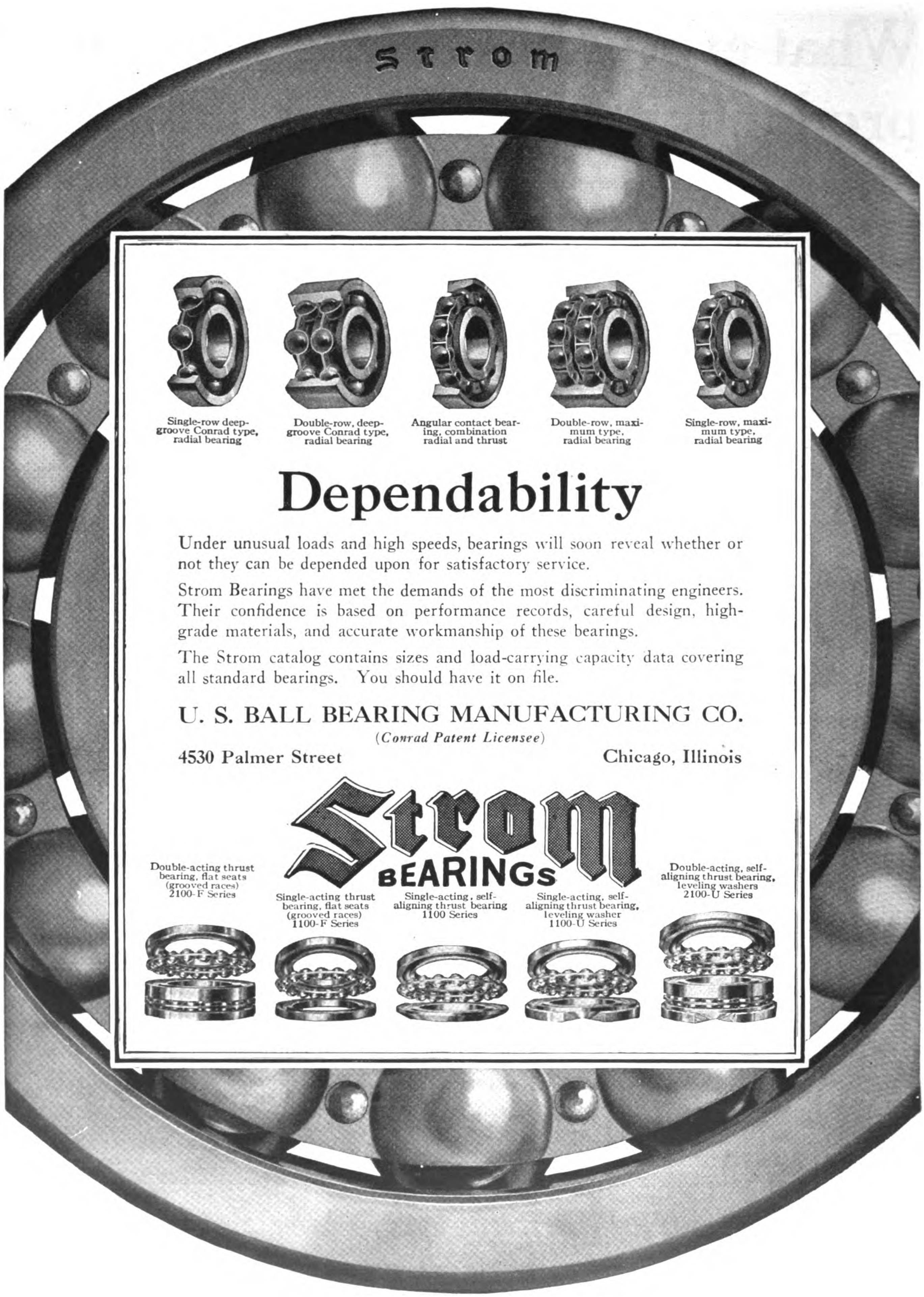
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Under unusual loads and high speeds, bearings will soon reveal whether or not they can be depended upon for satisfactory service.
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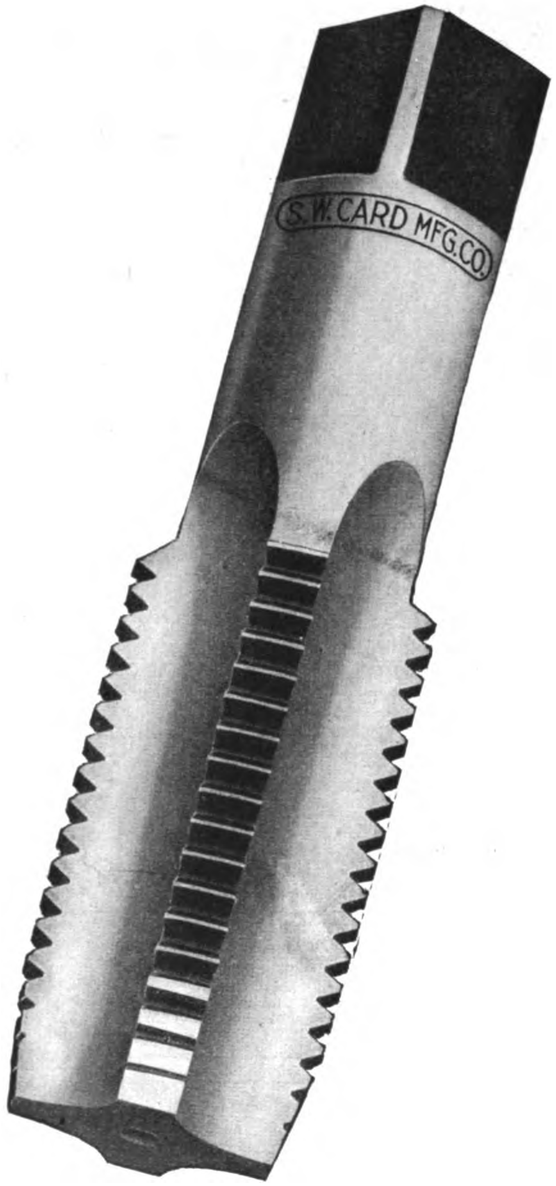

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in your plant, as
CARD Taps and Dies
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in your thread cutting

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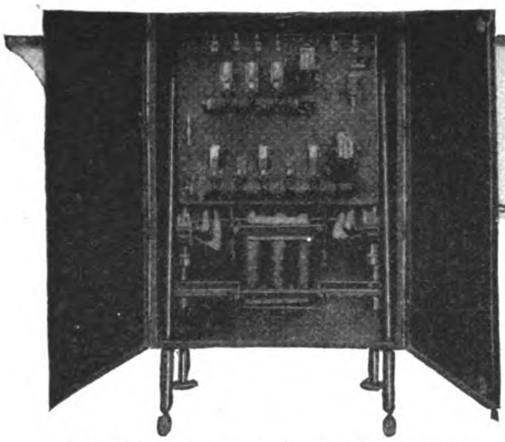
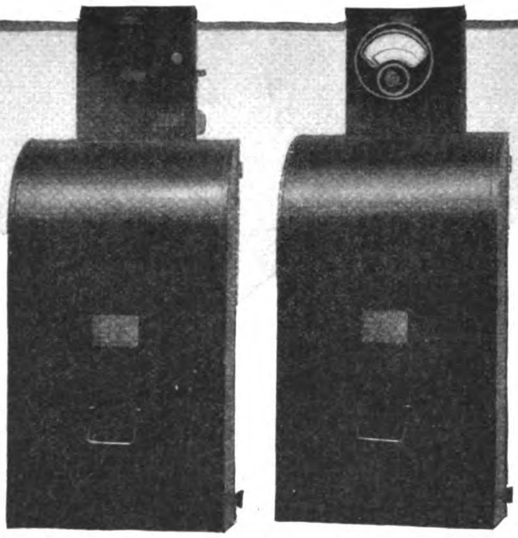
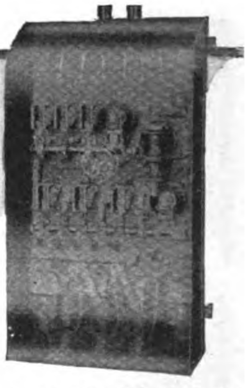
Automatic Starting Compensators for Squirrel Cage Induction Motors up to 600 Volts



G-E CR 7052 Automatic Starting Compensator—for floor mounting. For 3-phase 50- and 60-cycle motors 60 HP and larger, 220 V.; 125 HP and larger, 440 V.; 150 HP and larger, 550 V. For 3-phase 25-cycle motors 60 HP and larger, 220 V.; 100 HP and larger, 440 and 550 V. Minimum 2-phase ratings are somewhat different.



G-E Ammeter and Disconnecting Switch Attachments, and separable conduit wiring box of wall-type Compensator are designed with small knockout holes for convenient installation of either or both Attachments. These Attachments are for wall-type Compensators only.



*G-E CR 7052 Automatic Starting Compensator—for wallmounting. For 3-phase 50- and 60-cycle motors up to 50 HP, 220 V.; 100 HP, 440 V.; 125 HP, 550 V. For 3-phase 25-cycle motors up to 50 HP, 220 V.; 75 HP, 440 and 550 V. Maximum 2-phase ratings are somewhat different. **Equipped with separable conduit wiring box designed to be used with or without Ammeter Attachment or Disconnecting Switch.***

Thousands of G-E Automatic Starting Compensators are used today because of their incomparable performance—and their flexibility of application for Industry's needs.

Their construction is such that they can be installed easily, inspected readily, and operated with convenience and economy. Enclosing cases for all live parts provide safety for operators, and prevent tampering by others.

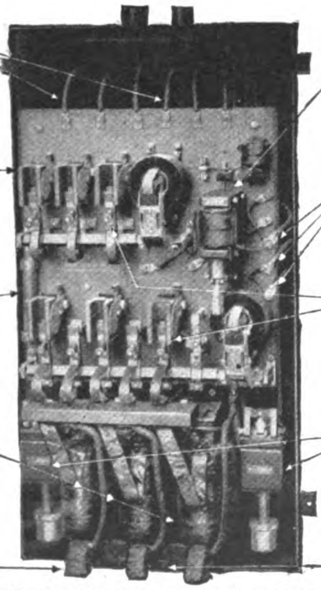
Terminals for motor and line leads. Liberal space for connections.

Contactors are suitable for severe service. They have solid copper tips, magnetic blowouts and moisture resisting coils, all accessible for easy inspection.

Fuse protects control circuit against accidental short-circuits when inspecting the equipment.

Three compensator coils for three phase give balanced starting conditions and maximum torque per ampere line current.

Accessible taps for selecting the most desirable starting voltage for any particular starting condition.



CR 7052-A1 Automatic Compensator with cover removed

Current limit relay automatically opens starting contactor and closes running contactor immediatly upon proper acceleration of the motor.

Terminals for control leads. Liberal space for running wires along edge of base to conduit wiring box.

Starting and running contactors open all lines to three-phase or two-phase three-wire motors.

Two inverse-time overload relays.

Padlock may be attached here to lock cover on.

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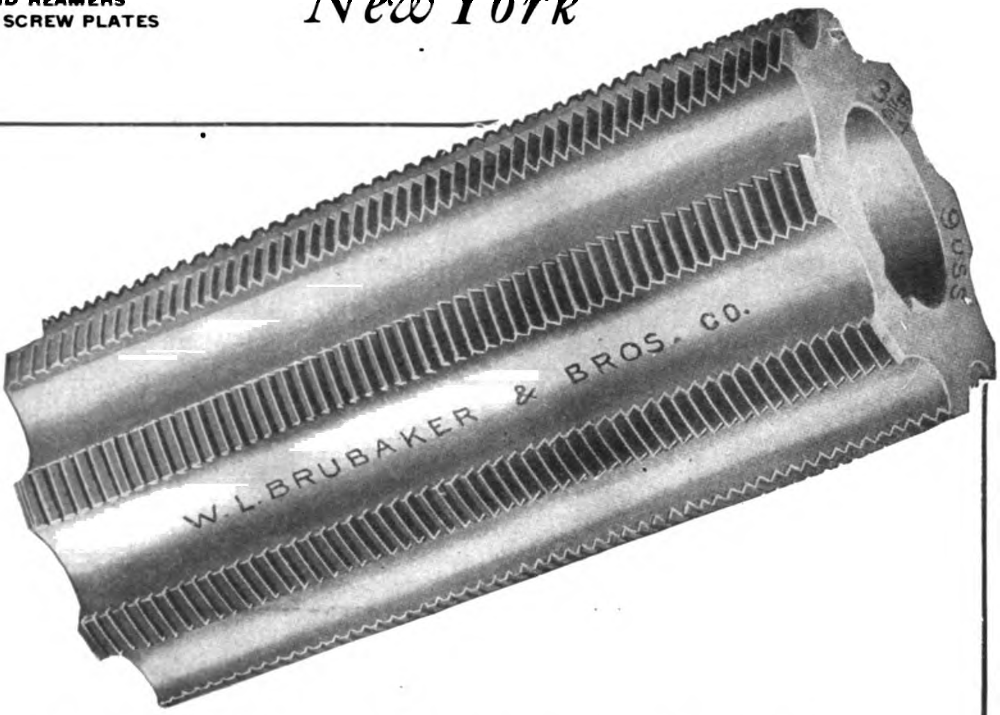

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Brubaker Stay Tube Taps are the natural selection of the builders of Grade "A" boilers.

They are machined from the best grade of Tool Steel. Their Special Temper and Correct Relief assure free and easy cutting.

We can furnish these Taps in Carbon or High-Speed Steel when desired.

Let us give you some of the advantages derived from the use of

Stay Tube Taps

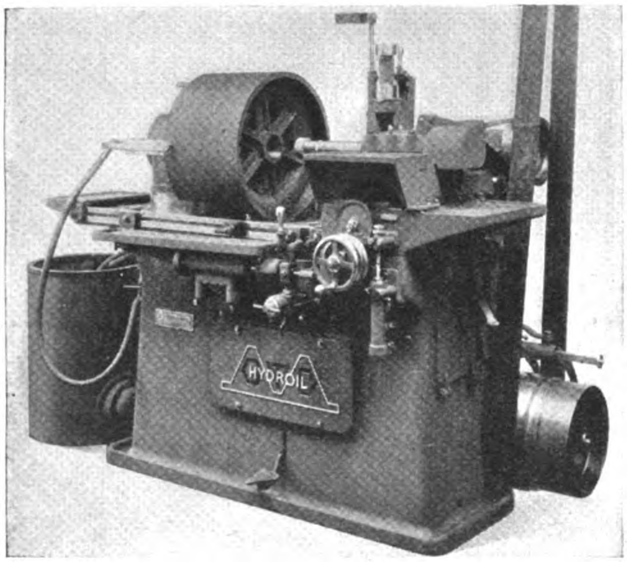
Any Sizes — Any Lengths — Furnished in 10 *days*

W. L. Brubaker & Bros. Co.

Factory at Millersburg, Pa.

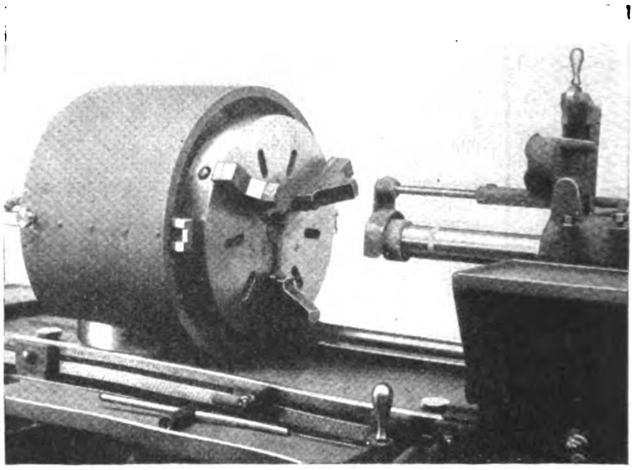
Little Stories of Real Production

Grinding Manganese Steel with "HYDROIL"



No. 52 "HYDROIL" equipped to grind 20-in. manganese steel sheaves.

REG. U.S. PAT. OFF.



Showing heavy chuck, blocked up work head and arrangement of wheel slide and water guard.

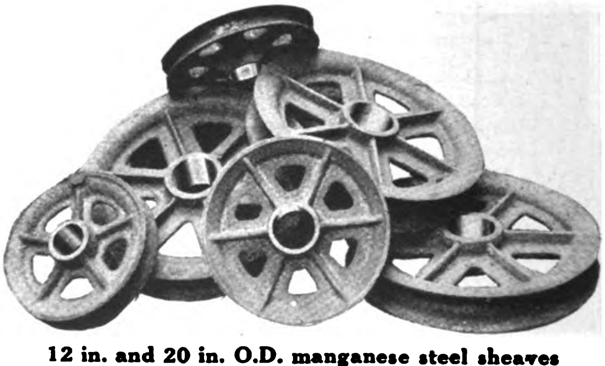
This was a job they all said was "wicked"

Sheaves for carrying mine cables must be made of the toughest material, to resist the eternal wear of grease and grit-coated cables. Manganese steel is used extensively because of its extreme toughness.

Once the center hole was finished in a lathe, and it was not uncommon to spend a whole day on one large sheave. "*Hydroil*" has taken hold of the job and put it on a production basis. They figure time in minutes instead of hours now.

A No. 52 "*Hydroil*" was provided with a raising block and special wheel slide to care for the large sheaves. (They are 20 in. in diameter.) The center hole is 3½ in. diameter and 4 in. deep and the average stock removed is .060 in.

Have you a tough job? The "*Hydroil*" Grinder may be just what you are looking for. Write for description and data covering this machine.



12 in. and 20 in. O.D. manganese steel sheaves internally ground on No. 52 "HYDROIL" Grinder.

The "HYDROIL" will be shown in action at the New York Auto Show, January 6-13 inclusive. Call at Booth No. C-5D Grand Central Palace

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FROM GILBERT'S 

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Before Gilbert died in 1603, he had done much to explain magnetism and electricity through experiment. He found that by hammering iron held in a magnetic meridian it can be magnetized. He discovered that the compass needle is controlled by the earth's magnetism and that one magnet can remagnetize another that has lost its power. He noted the common electrical attraction of rubbed bodies, among them diamonds, as well as glass, crystals, and stones, and was the first to study electricity as a distinct force.

"Not in books, but in things themselves, look for knowledge," he shouted. This man helped to revolutionize methods of thinking—helped to make electricity what it has become. His fellow men were little concerned with him and his experiments. "Will Queen Elizabeth marry—and whom?" they were asking.

Elizabeth's flirtations mean little to us. Gilbert's method means much. It is the method that has made modern electricity what it has become, the method which enabled the Research Laboratories of the General Electric Company to discover new electrical principles now applied in transmitting power for hundreds of miles, in lighting homes electrically, in aiding physicians with the X-rays, in freeing civilization from drudgery.

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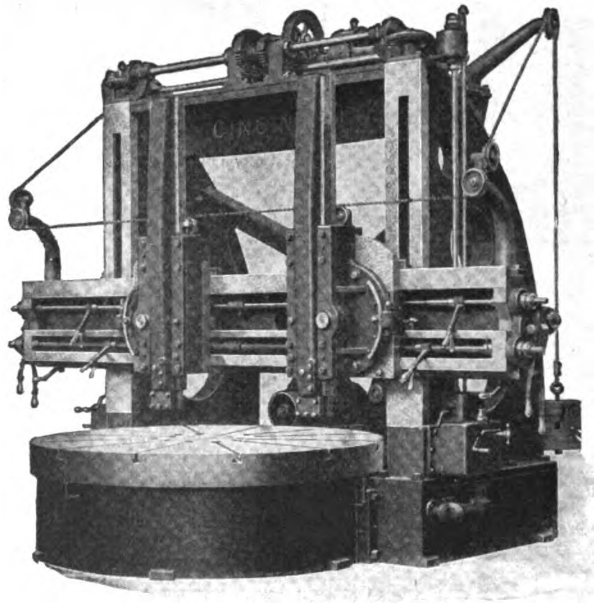

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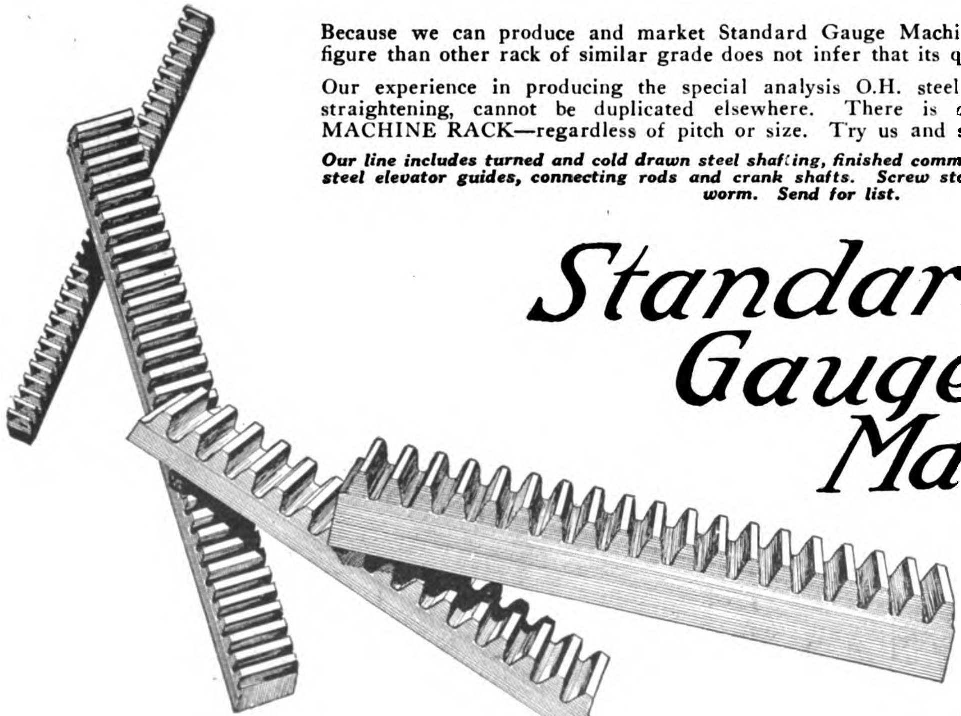

Standard Gauge Machine Rack

GSS

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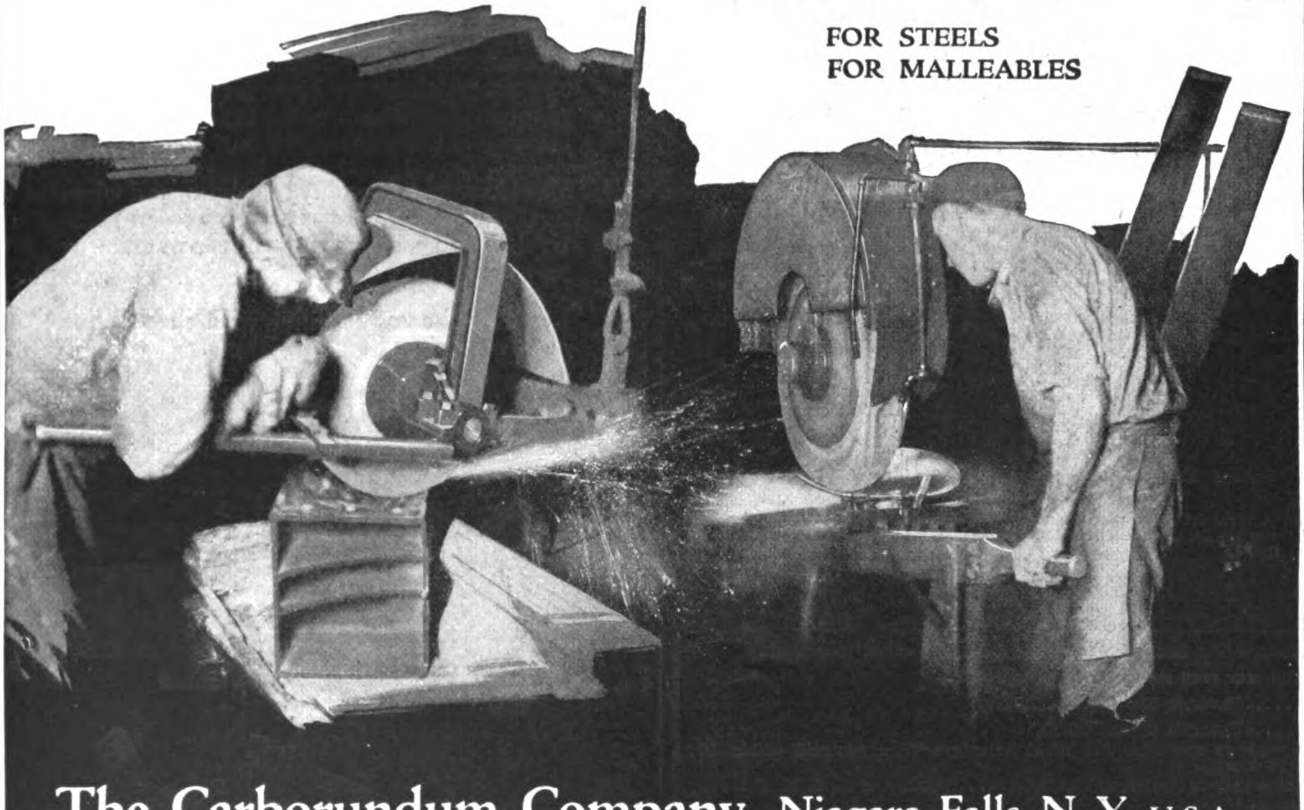
It is a durable wheel that shows long enough life to be economical—yet it has the astonishing speed of cut.

Our Sales Service Department will gladly see to it that you get the right wheel in the right place.

Aloxite Grinding Wheels

FOR STEELS
FOR MALLEABLES



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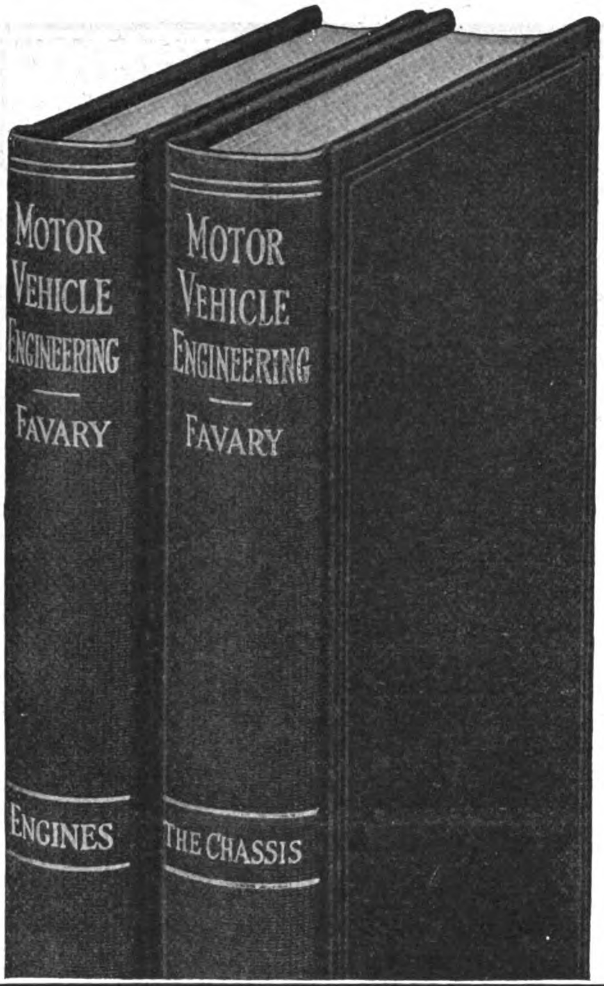

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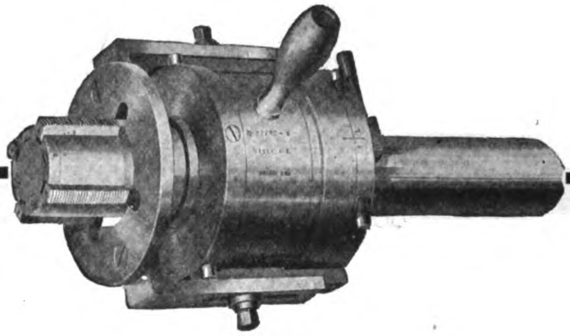
you get a better threaded job with

Geometrics



GEOMETRIC Collapsing Taps usually advance production a full 50% over that resulting from using solid taps. Backing out time is minimized and thus threads are not damaged nor crossed.

Whatever the need in screw cutting, there is a Geometric to take care of it. Adjustments to correct diameter each time a thread is tapped. The Chasers collapse automatically, leaving the thread clean cut and perfect.

The Chasers are readily reground, and when finally used up, are renewed at comparatively small cost, leaving the tap as efficient as when new.

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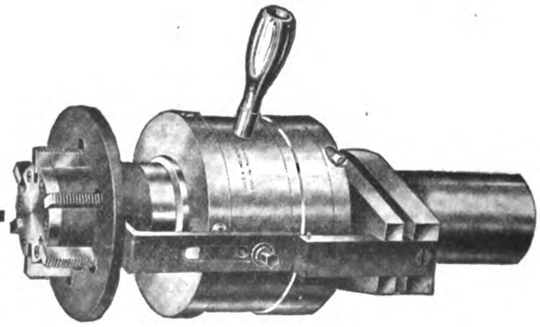

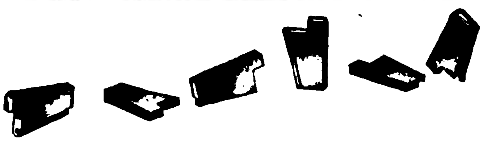

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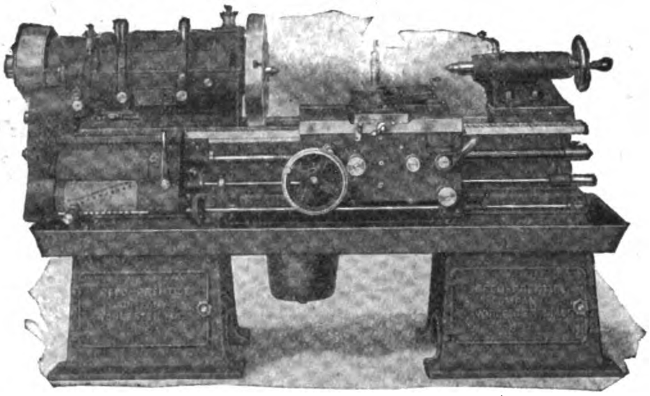

It is a powerful production lathe that assures an increase in the quantity and accuracy of the work, besides exceedingly low operating and maintenance costs.

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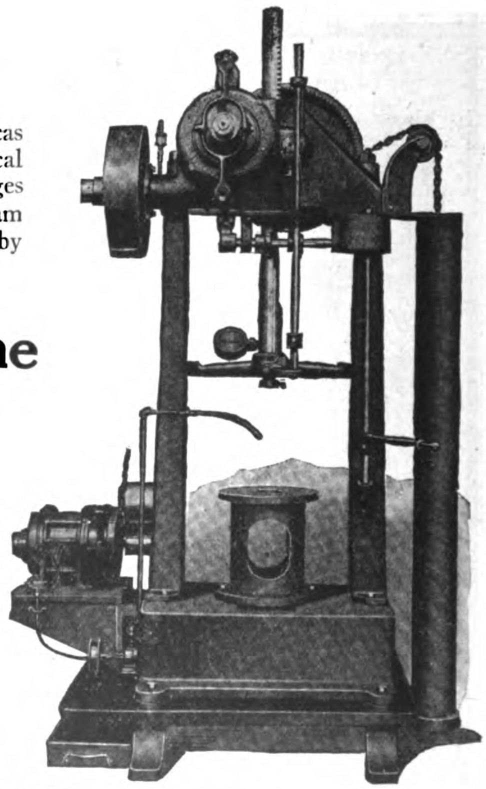
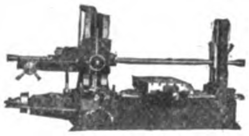


WE ALSO MAKE THE
"PRECISION"



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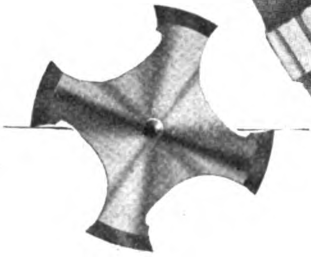
Ground Taps

are different from any thread cutting tool you have ever used. They are absolutely reliable because of their correctness in size, lead and angle. Let us send you a circular that explains in detail.



PATENTS PENDING

John Bath & Co.

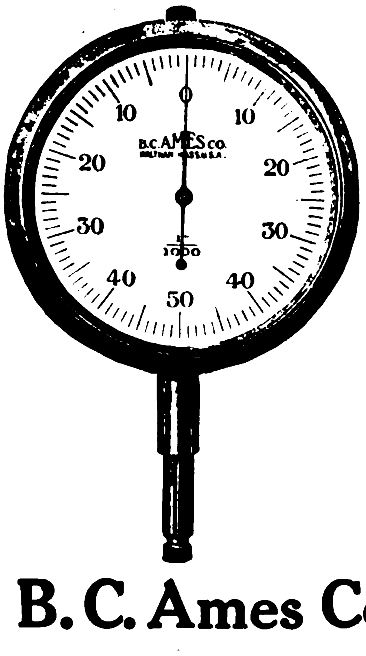
Worcester, Mass.

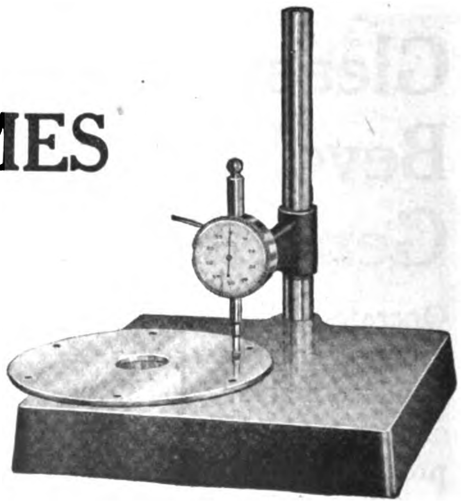
AGENTS: William S. Morse, 421 Book Building, Detroit, Michigan, R. E. Ellis Engineering Co., 621 Washington Blvd., Chicago, Ill. R. E. Ellis Engineering Co., Majestic Bldg., Milwaukee, Wis. Louis G. Henes, San Francisco and Los Angeles, Calif. The Stickels Co., 10 East 43rd Street, New York. C. M. Bigger & Co., Cincinnati, O. The Commercial Steel & Supply Co., Plymouth Bldg., 2026 East 22nd St., Cleveland, O. Wesson Sales Co., First National Bank Bldg., Detroit, Mich. Laughlin-Barney Machinery Co., Pittsburgh, Pa. (Union Arcade).

"Ground from the Solid"

You can't go wrong with the AMES

There's no guesswork about limits when you check your work with the **Ames Dial Gauge.** The dial shows just how much "over" or "under" the piece has been machined and the mechanic can thus go ahead and work to known figures.





AMES Dial Gauges

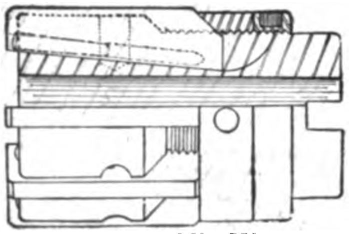
prove invaluable as checks on duplicate part production. There is practically no gauging job they cannot accomplish and the time they save assures greater profits.

The **Ames** comes in a number of different styles, thus enabling you to meet your gauging needs with exactness.

Let us tell you all about this and the other AMES products.

B. C. Ames Company, Waltham, Mass., U.S.A.

Sectional View.
Shell Type



Group II No. 550.

One of the three distinct types designed to meet all requirements

Davis
Expansion Reamers

(Patented 1912)

Simplicity—
the keynote of efficiency

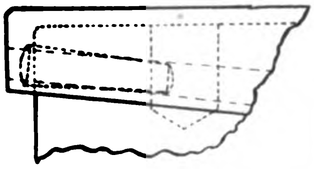
In the simple design, is found the principal factor of Davis Expansion Reamer efficiency. Here, numerous features and advantages are embodied that simplify the operator's responsibility to such extent, as to insure definite results with minimum effort.

The unique engineering principle involved in the method of holding blades (with hardened and ground taper pins), is the most singular feature of Davis Expansion Reamers. Taper pins, fitted as shown in illustration, have 100 times the holding power of separate blade screws.

Expansion of blades is uniformly forward on taper—thus eliminating circular grinding when adjusting; while the ends of blades project and cut in advance of reamer body for perfect bottoming.

Many other distinctive features, including liberal range of expansion with blades interchangeable in various size reamers, will interest those who are anxious to realize the full possibilities in their reaming production.

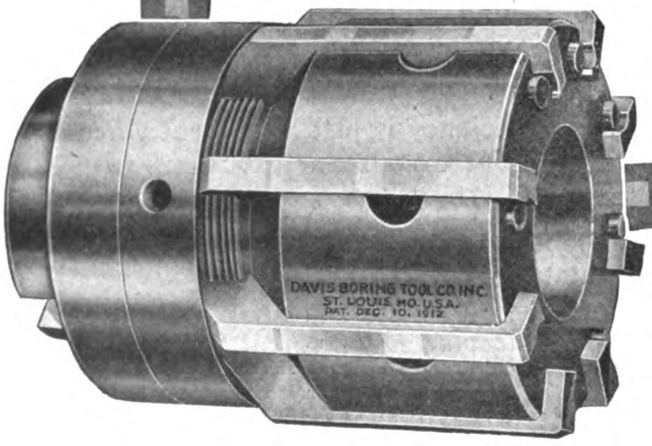
Reamer Catalog No. 540 tells the full story in an interesting manner. Send for it today.

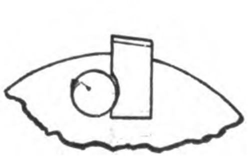


The taper pin is fitted almost entirely in the reamer body, at special angles, so that entire length of taper pin has perfect bearing in blade groove. Line contact only, in blade groove, results in a constant downward and lateral thrust that does not interfere with free movement of blades in adjustment.

Davis Boring Tool Company
Incorporated
3706-30 Forest Park Boulevard
St. Louis, Mo., U. S. A.

We Supply the World with Expansion Boring Tools and Expansion Reamers.

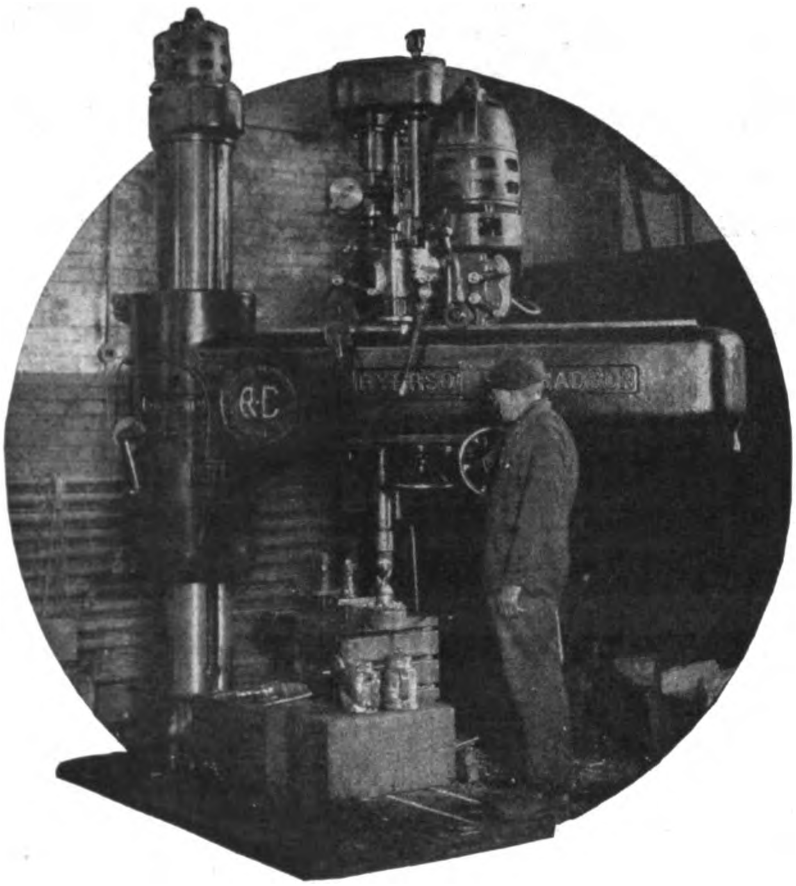




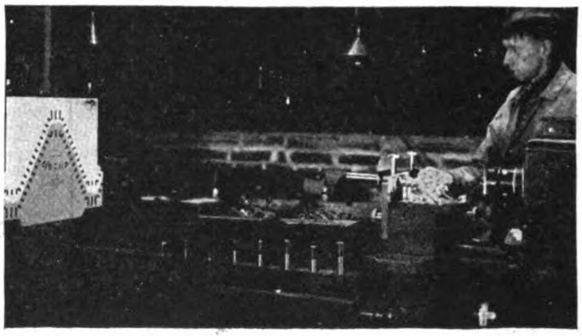
Note how contact of taper pin in blade groove exerts a downward and lateral thrust.

Shell Type.
Group II No. 550

LARGEST EXCLUSIVE MANUFACTURERS OF EXPANSION BORING TOOLS AND EXPANSION REAMERS



The Gage Method of Screw Thread Inspection



The Hartness Comparator Method

Cut the cost of your screw thread inspection and make it infallible during the new year

The HARTNESS Screw Thread Comparator offers you the opportunity to do just that.

Look at the old method on the left. Note the size of the force you have to maintain for screw thread inspection with the gage method.

Then see how one man with the Hartness Screw Thread Comparator handles the same job.

But that isn't all. The gage method REJECTS some of the BEST screws and ACCEPTS some of the WORST. The Hartness method rejects only those that are actually bad and accepts only those that are actually good.

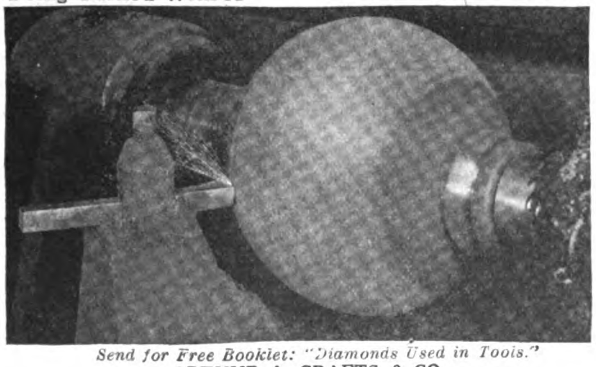
You can readily appreciate the truth of this when you stop to consider that with the ring gage method the threads fit or they don't fit. Your inspector cannot tell just what the trouble is. With the Comparator, however, the character of every feature of the thread, such as size, lead, surface, etc., is made clearly visible to the eye. When you can see just what your thread troubles are you can soon eliminate them and cut down your rejections to practically nil.

From whatever point you look at it the Hartness Comparator Method is considerably less costly and productive of better results than any other method of inspecting screw threads.

It is not a hard task to prove it to you conclusively. May we do so?

Jones & Lamson Machine Co., Springfield, Vt., U. S. A.

This Bowling Ball Is Being Turned With A **DIAMOND**



Send for Free Booklet: "Diamonds Used in Tools."
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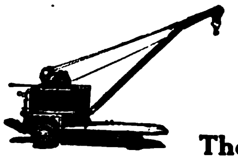

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Ready to Save the Cost of Wasteful Hand Trucking

Request Catalog 811.

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hold their cutting edges for months. Can easily be sharpened and will last for years. Leave a smooth, true and finished surface. These special shaped carbon, black diamond, pointed tools are best for turning paper, cotton, corn husk, rag, fibre, hard rubber, etc. They turn out a large number of pieces of exact uniform size.

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Successor to John Dickinson. Estab. 1796

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MACHINE HANDLES
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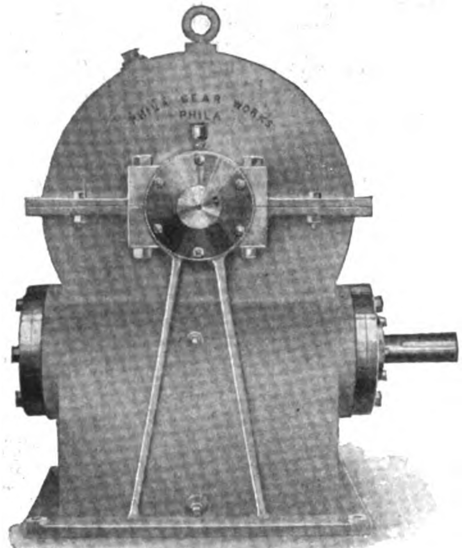
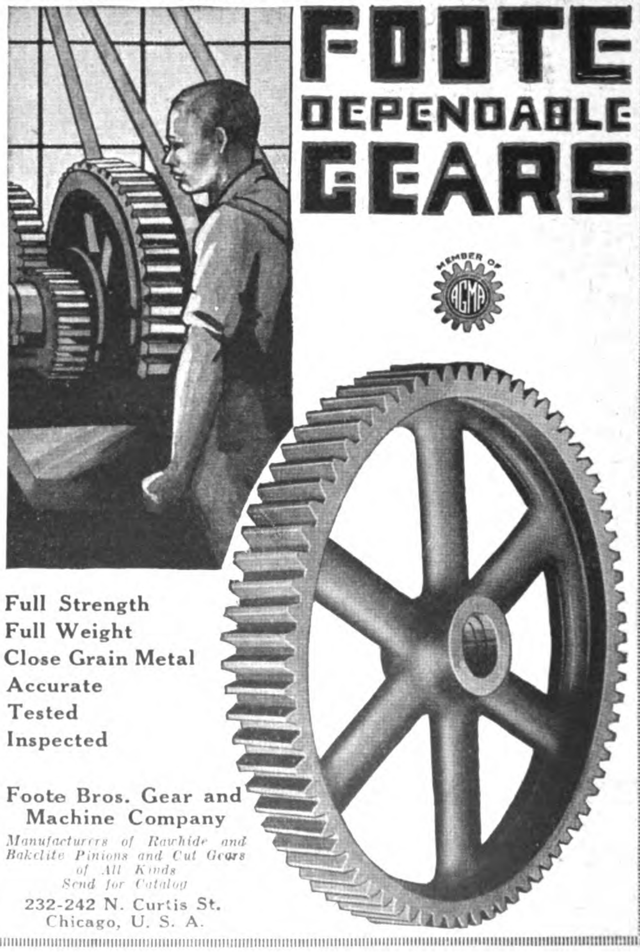
Pick-up, Carry and Elevate 4000 lb. loads

A new series of installation folders showing users of the LAKEWOOD TIER-LIFT TRUCK in different industries may offer suggestions for similar economies in your plant.

Ask for Series A

Lakewood Engineering Co., Cleveland, O.





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GRANT

Hitherto the average output of riveting machines has been greatly decreased by the necessity of hand riveting inaccessible parts.

The Grant Rotary Vibrating Riveter has a specially designed head which allows it to reach those awkward corners, which would otherwise have to be done by hand.

Drives sixty good rivets a minute. No damaged heads or twisted shanks.

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Riveting by Multi-Blows

Our machine puts polished heads on rivets by striking a multitude of light blows—80 to 1000 per second. It does not distort or upset the work at any point except the heads. Tremendous speed and perfect finish are the features. *Circular?*

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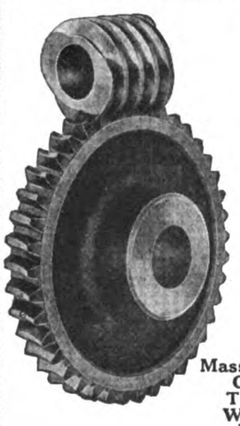

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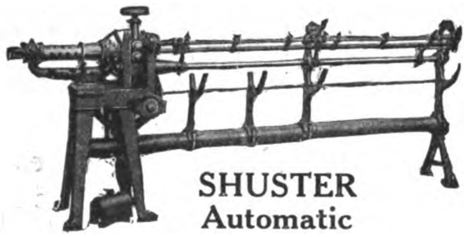

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Wire Straightening and Cutting Machines

require practically no attention after the coil of wire is inserted, so the operator has most of his time free for other work.
They make the wire perfectly straight.
They cut absolutely accurate lengths. At very small cost.

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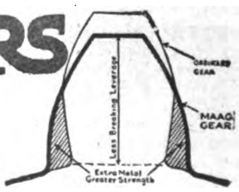

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Where Others are Weakest
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5 P or finer spur or worm gears 36 in. or smaller
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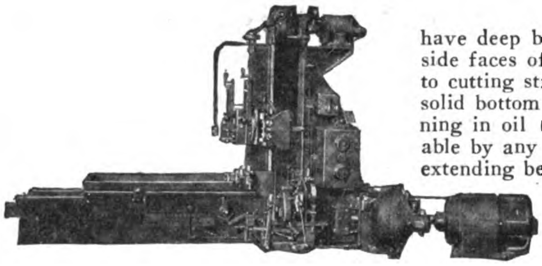

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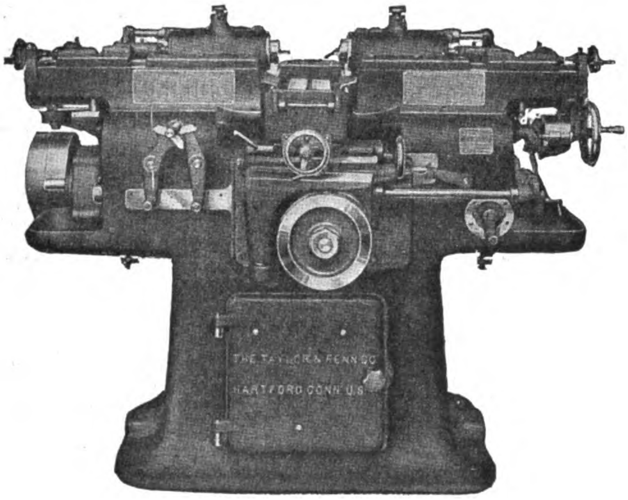

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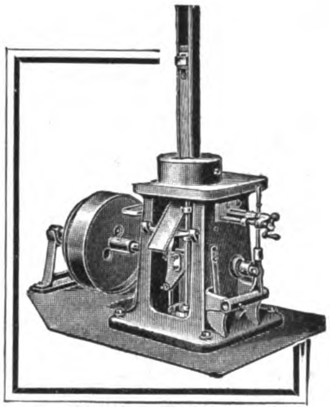

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It is a machine that for many years has stood out as an example of very speedy operation coupled with simplicity of set-up and precision. Cuts any type keyseat, straight or tapered.

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Members of the crew are on the job at all hours awaiting the call to duty—which duty involves the truing-up, repairing or overhauling of engines, no matter where, *nor when!*

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Established 1870 Philadelphia, Pa.

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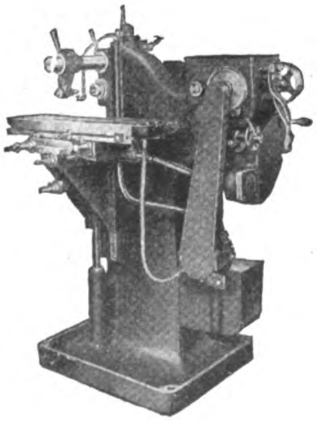

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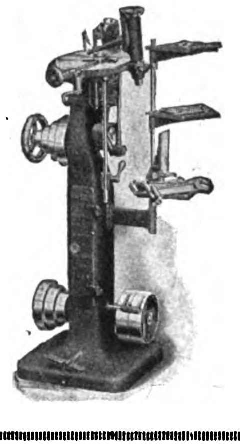

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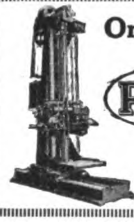

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It is equipped with automatic feed, which is so designed that it relieves the cutter on the upward stroke, and can be set to cut keyways of required depth. No further adjustment required to cut similar key-ways in other hubs. Cutter feeds up to the work. Machine runs as easily on large jobs as on small.

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Hall Planetary Thread Millers

Reduces threading cost 50% on some classes of work. Cuts all style threads internal or external.

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AUTOMATIC
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No Special Cams Needed. Uniform feed. For jobbing as well as long runs.

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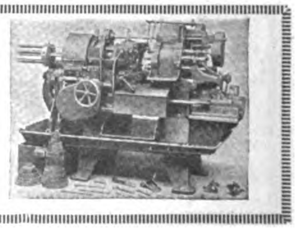

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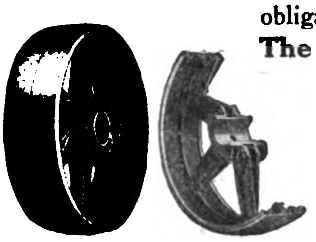

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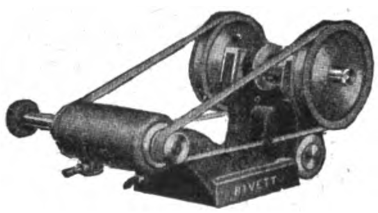
A Tilton Endless Wooven Belt for all difficult drives



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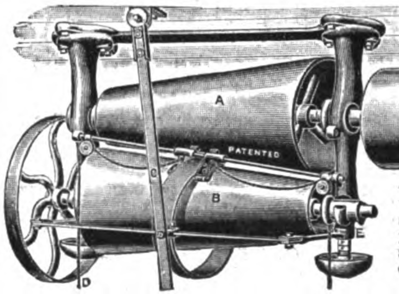

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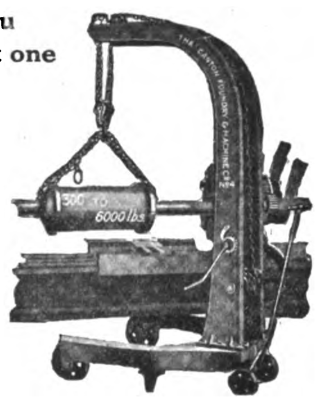

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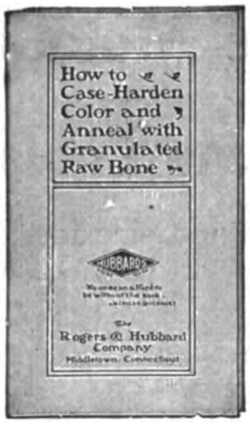

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Gas Blast Burners, Furnaces, Heating-Machines for every industrial purpose; also Positive Pressure Blowers.

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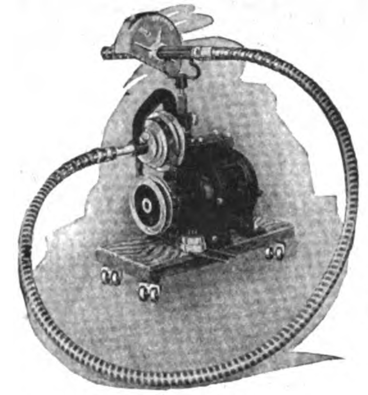
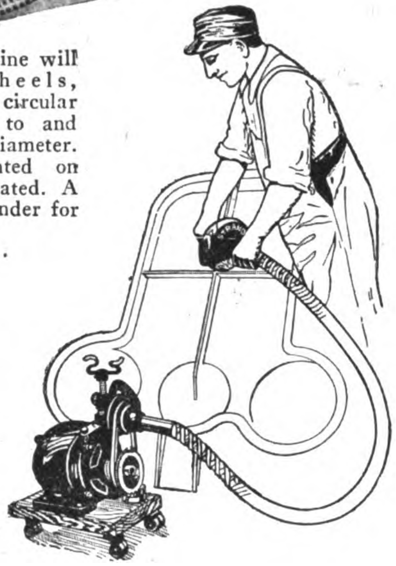


Strand

A Sturdy Machine



This type M-7 machine will carry grinding wheels, polishing wheels, or circular scratch brushes up to and including 8 inches diameter. Motor, 1-hp. mounted on castor base as illustrated. A good all around grinder for the foundry.

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N. A. Strand & Company

Originators of the three speed motor drive for flexible shafts

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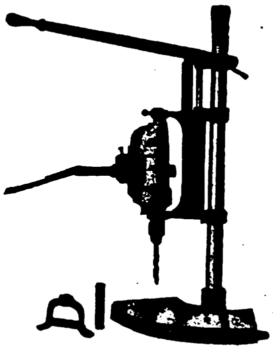

Stand-by tools are necessary regardless of initial cost and overhead, but both can be kept to a minimum for your drilling work, provided you buy U. S. Electric drills and drilling stands. At the cost of one single purpose bench drill, you have both a portable electric drill and a bench drill.

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4000 in daily use—Write to-day for descriptive matter and prices.

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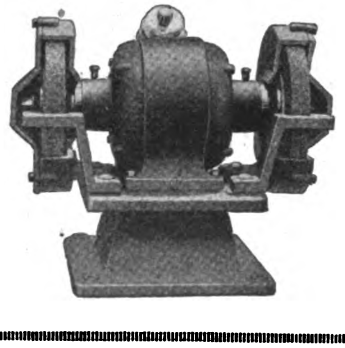

Guards are heavy and adjustable. Exhaust guards can be furnished in place of plain guards when desired.

Our complete line of motor grinders comprises 7 sizes.

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Every type and size for every kind of service.

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Offices in 45 American Cities

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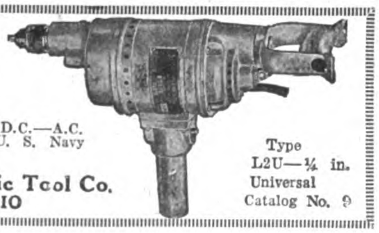

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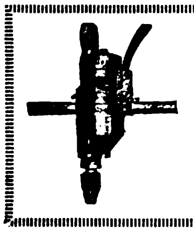

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All styles and sizes **and Grinders**

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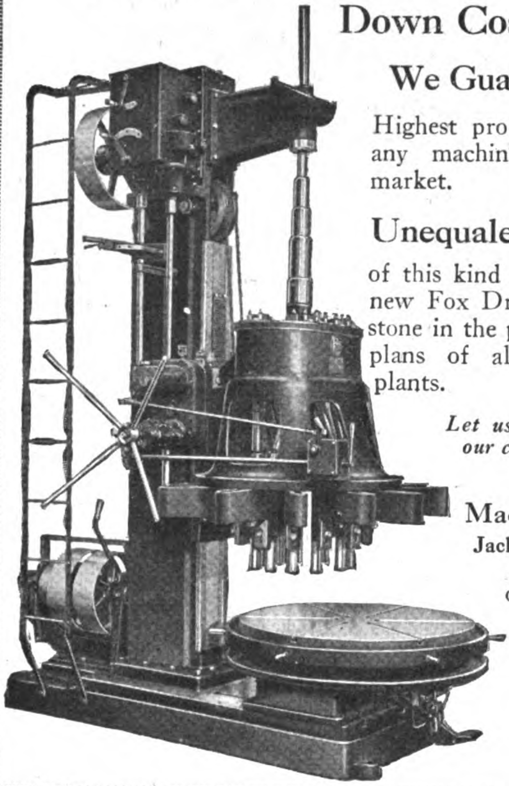

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Power Transmission And Lubrication Approach Perfection

Our latest **ALL Geared** and **Self-Oiled** Drilling Machine is a revelation in accuracy, speed and power output.

No troublesome belts or cone pulleys. Wear reduced to the minimum

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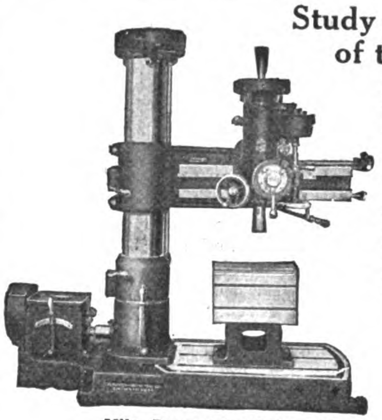

Note well the heavy base and column, the ample bearing surfaces of the arm; the compact head construction and the convenient positions of all controls.

We can't give detailed specifications in this small space, but our catalog is yours for the asking. Get it now and conclude your investigations.

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Either Horizontal or Vertical Spindle Type, Countershaft or Motor Drive

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Various sizes, both Power Feed and Hand Operated, for work up to 54 inches in length.

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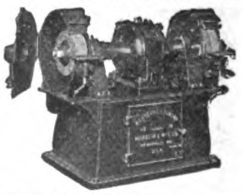

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HUNTINGTON and all other types of GRINDING WHEEL DRESSERS
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Parker Spindles, used on your internal grinders, mean *increased production, higher speeds,* and *greater economy.*

Equipped with Parker High Speed Ball Bearings.

Let us send you literature. Let us tell you how these spindles have saved thousands of dollars for others, and how they can do the same for you.

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are made in single, double, triple, quadruple spindle and bench types. Fitted with No. 1 Morse Drill Taper and provided with clamp stops that may be instantly adjusted to meet any desired hole depth.

All bearings are the standard commercial type ball bearings thus simplifying replacements when necessary.

Perfect balance is a feature in these machines.

Ask us about this new line of Drill Presses. We can also furnish plain bearing machines.

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BUILT IN FOUR DIFFERENT SIZES

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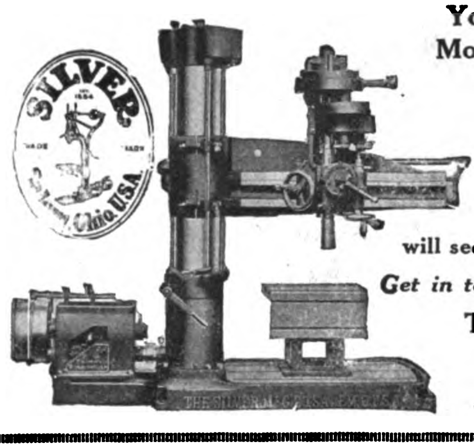

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Fits Any Spindle Drills Any Pattern

3 to 12 HOLES. Built for fast production.

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"Hole Hog" Multiple Drillers and Borers increase the output and reduce production costs. Save in every direction. Increase the capacity of your plant by using "Hole Hogs" instead of building an addition. Tell us your needs.

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TRADE MARK REG. U. S. PAT. OFF.

High Speed Ball Bearing Sensitive Drills and Heavy Duty Radials

Advanced design and high grade construction make them the logical tools to use for efficient, low cost production. Investigate.

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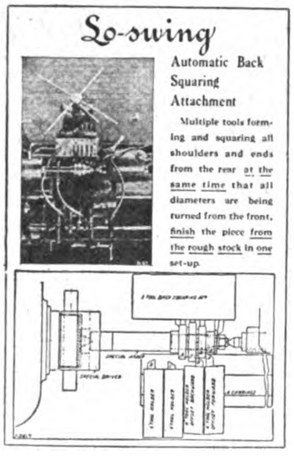
It Contains Useful Information For The Production Engineer

So-swing



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Hand Operated
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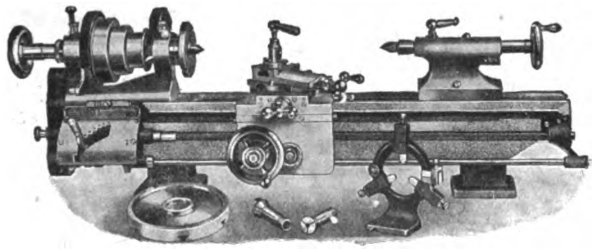

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Swings 8½ in., 24 in. between centers, accurate lead screw, Automatic cross feed, quick change gear box, tool steel bearings, head and tail spindle hardened ground, lapped.

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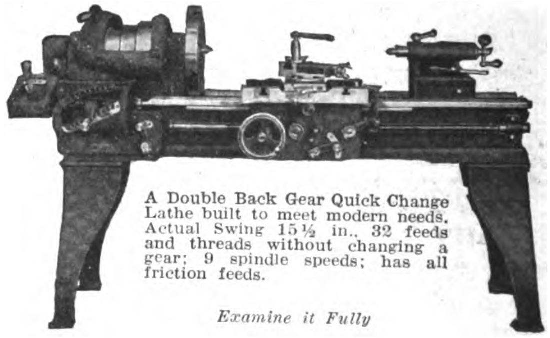
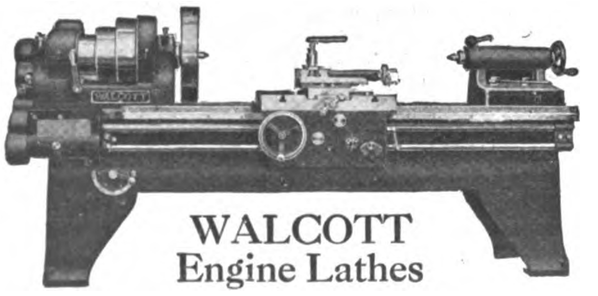
A Remarkable 14-Inch Lathe for $450.00!



The Carroll & Jamieson Machine Tool Co.
Davis Ave., Batavia, Ohio



A High-Grade Lathe—at Low Cost!

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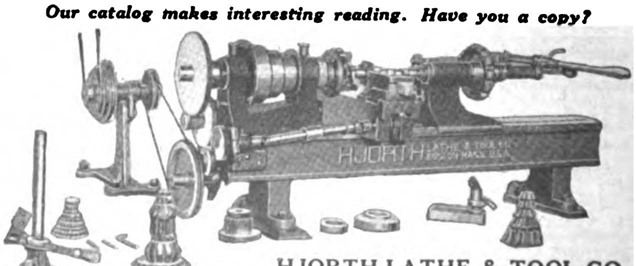
Adaption to Circumstances as Expressed By
HJORTH LATHES

No matter what job comes along, within the range of light machine work, you can handle it efficiently on the **Hjorth Precision Bench Lathe.** The very complete list of attachments give this machine quite unusual range.

Our catalog makes interesting reading. Have you a copy?



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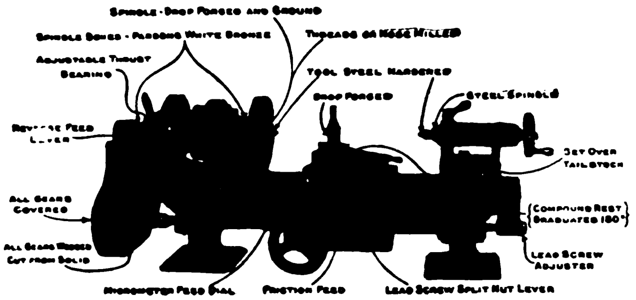
Type B-4 "DALTON SIX"

METAL WORKING LATHE

THE SMALL LATHE for the BIG JOB



Standard Bench Type

Swings 7¼ inches
Turns 13 inches, 30 in. Bed
Cuts Threads 3-144.

Price
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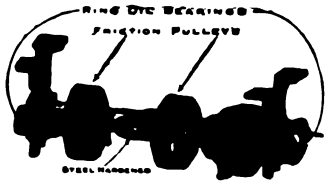
Complete as illustrated, including set of change gears and wrenches. F.O.B. Factory. Furnished also on High Legs; also Foot Power or Motor Driven.



Can be applied to either ceiling or wall

This machine can be furnished with Bed 36 inches long, at extra cost

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CABLE ADDRESS: "ALEDAL" STAMFORD, CONN., U.S.A.

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Every Part a Real Working Unit

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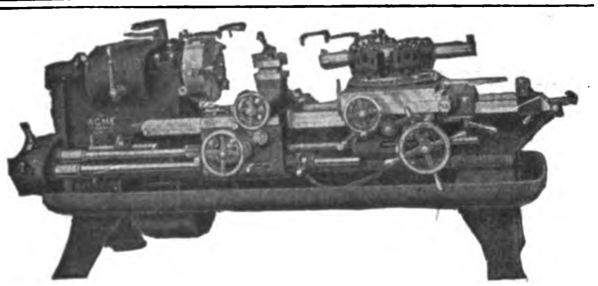
That's why **Flather Lathes** are in high standing with the men who use them—the men whose judgment, of a machine's working qualities, is valuable.

There is a type built for every purpose, but no matter which you select, you'll get value in the tool and in its work.

Will be glad to advise. Send us your requirements.

Flather & Company, Inc.
Nashua, N. H.



No. 3 Cincinnati-Acme Universal Flat Turret Lathe

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The need to kill *more than* two birds with one stone

In recent years it has become increasingly important that the greatest possible number of operations be concentrated on the one machine. This is because labor is by far the most expensive item on the production sheets and each extra tool means extra labor.

Under competitive conditions it is very clear that the man, who can beat his opponents on production cost, is the man who can beat them in the markets.

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Write us now.

The Acme Machine Tool Co.
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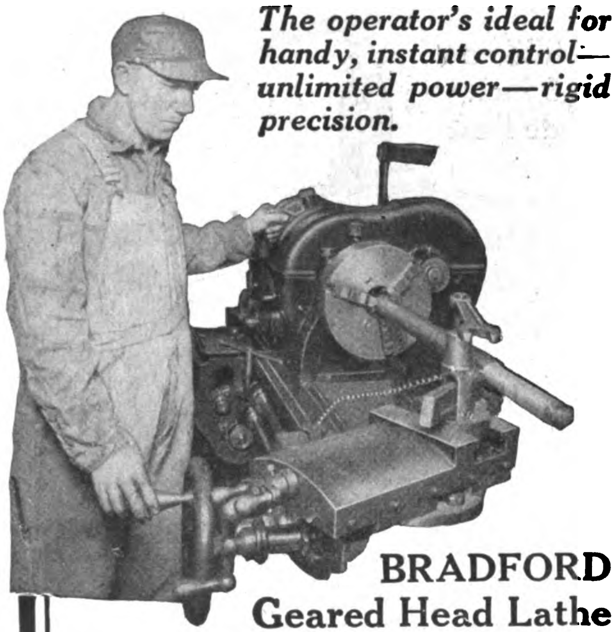
Manufacturers of Cincinnati-Acme Turret Machinery



The operator's ideal for handy, instant control—unlimited power—rigid precision.

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Geared Head Lathe

Gears cannot be shifted under load. Feed rod and lead screw cannot be engaged simultaneously. The few speed and feed controlling handles are placed where the operator instinctively reaches for them. No electric brake or electric control of any kind is necessary.

Besides the famous Bradford low drive principles with its "down pull" and shock-absorbing gears, eliminates the chatter common to geared-head lathes, and preserves Bradford precision noted for a quarter century against years of heavy cuts and fast feeds.

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The Bradford Machine Tool Co.
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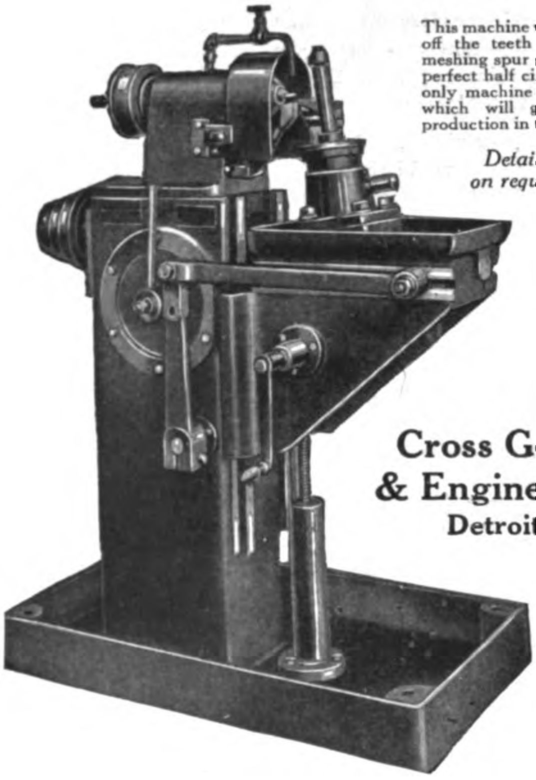
CROSS

Gear Tooth Rounding Machine



This machine will round off the teeth of intermeshing spur gears to a perfect half circle. The only machine we know which will give high production in this work.

Details on request

Cross Gear & Engine Co.
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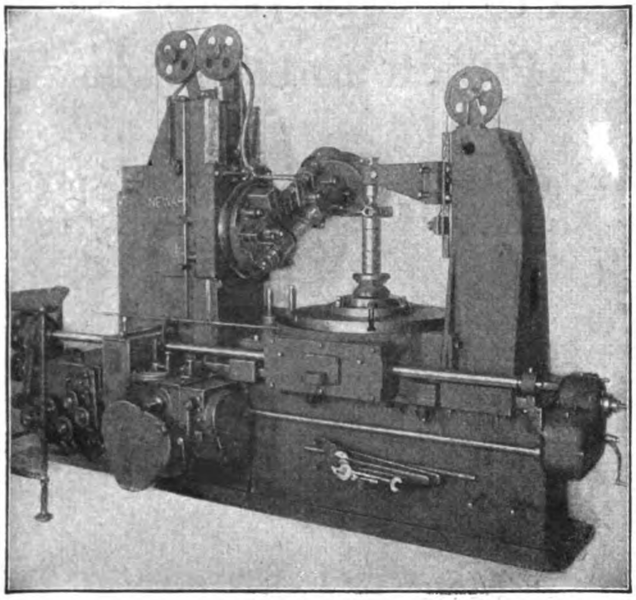

Newark Hobbing Machine

The growing use of herringbone-gears demands that they be cut on the proper machine.

The NEWARK Hobbing Machine is designed just for such work as herringbone and helical gears. It saves time in setting up and in cutting; and time represents money. The gears are cut with the greatest accuracy.

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Henry E. Eberhardt, President
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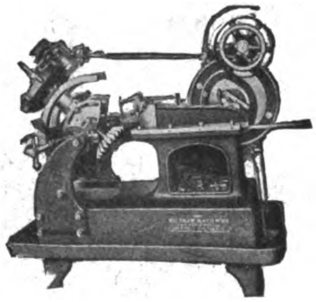
Gear Cutters—Gear Hobbers

For Spur and Spiral Gears

A complete line of automatic machines for automotive and industrial requirements.

The Cincinnati Gear Cutting Machine Co.
(Subsidiary of The Cincinnati Shaper Co.) **Cincinnati, Ohio**

Gears Cannot Be "Broken In"



Either they are efficient to start with or they never will be efficient.

Bilgram Bevel Gear Generators will ensure the perfection of the gears in your product—will make them a definite selling point.

If, on the other hand, you use ready cut gears, we have unusual facilities to fill your requirements in all types.

Write us about your gear problems.

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Pipe Cutting and Threading Machines
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"Better Threads at Lower Cost"

WILLIAMS TOOL CORPORATION
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Libby Turret Lathe

A superior machine made by a man who is familiar with machine shop requirements. Machine is strong, powerful and rigid. Adaptable to entire range of heavy bar and chuck work. Let us give you full details.

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Hamilton Lathes, built in a wide range of sizes and styles, reach the peak of modern precision—plus—production. Their economy, viewed from any angle, makes it advisable for you to get complete description at once.

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PIPE THREADING AND CUTTING MACHINERY

All Sizes $1/8$ to 18 in. inclusive

D. Saunders Sons, Inc., Yonkers, N. Y.

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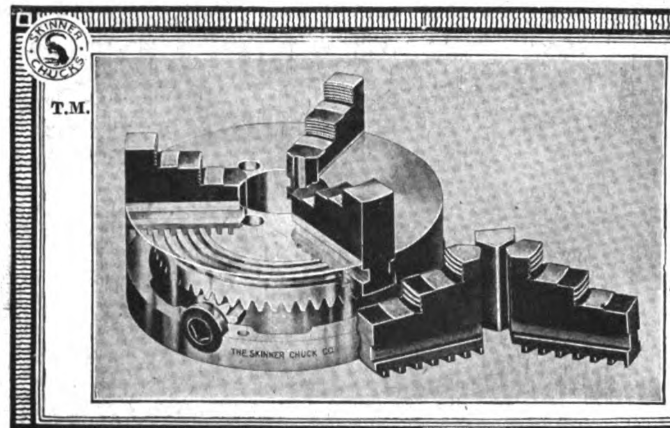

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Geared Scroll Type

The ideal chuck for repetition work. It insures a powerful grip. The jaws operating universally can be tightened by applying the wrench to any single pinion. For general manufacturing purposes the Skinner Geared Scroll Chuck has no equal.

Illustrated literature and catalogue upon request

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NEW BRITAIN, CONN U.S.A.
ESTABLISHED 1887

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Waiting to get their Teeth in

There are **Whiton Chucks** just waiting to get their jaws around your work. Perhaps you do not fully realize their advantages.

The body, for instance, is cut from a solid block of steel. This means that there are no weak spots and no seams to open up under heavy cuts. The jaws are unusually heavy, are reversible and can be operated either independently or universally. The scroll mechanism is simple and solid.

In fact, we never knew a Whiton that failed.

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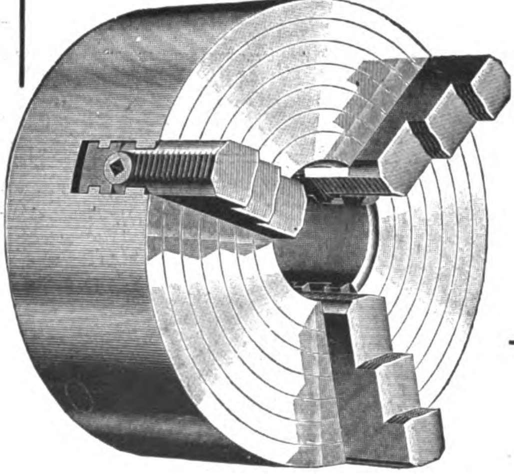
"Whiton" Chucks are sold and kept in stock by principal dealers all over Europe



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On the Experience of the Past

The Cushman Chuck Company has been building for the future for sixty years. It is doing it to-day. This is the reason that, when the need appears for a better holding device, there is a Cushman Chuck ready to meet it.

STYLE 214

"The Incomparable"
THAT NEW STEEL CHUCK
Ask your dealer about it.

THE CUSHMAN CHUCK CO. HARTFORD CONN. U.S.A.

SWEETLAND CHUCKS

of the Geared Scroll type have one inside and one outside set of jaws. These jaws are ground perfectly true on the face and bite, after being hardened.

Four jaw type if desired.

Ask us to show you the Sweetland Line.

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Production Tools—
Air Operated Chucks and Adjustable Boring Bars

Air-operated Arbor Presses, Chucks, etc.; Countershafts, Vises, Mandrels and Clamping Devices, Adjustable Boring Tools, Multiple Boring and Reaming Tools, Adjustable Reamers, Line Boring and Reaming Bars, and Cylinder Boring and Reaming Tools, Car Wheel Boring Bars.

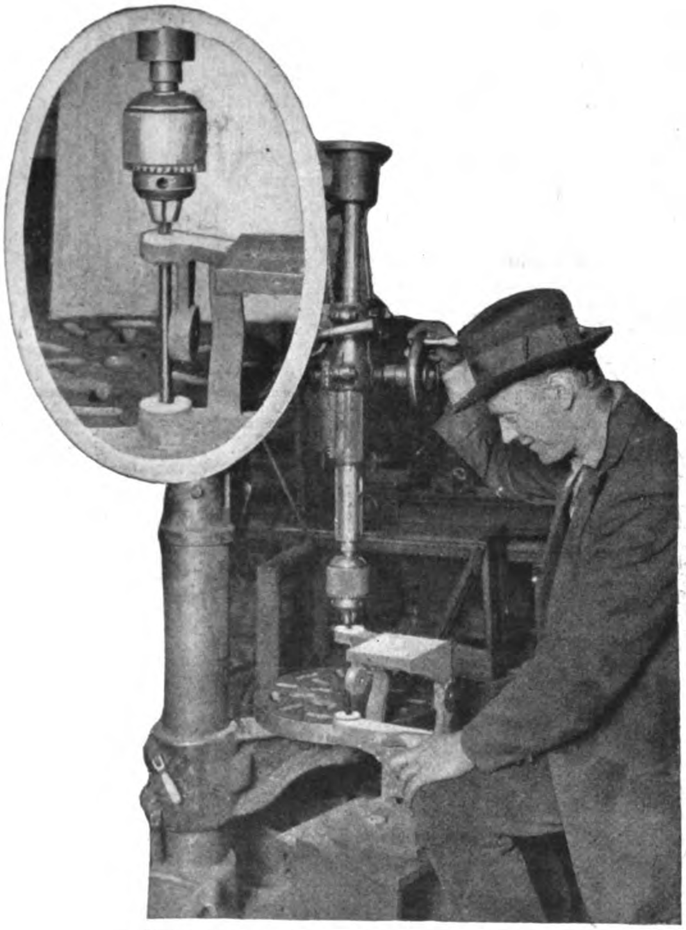
Catalogues on Request

HANNIFIN AERO CHUCKS M'F'G CO

Hannifin Manufacturing Co.
Harrison St. and Kolmar Ave., Chicago

Jacobs Quality Chucks

Variety performance pays big dividends



The purchaser of a Jacobs Drill Chuck knows that he possesses a superior unit of drilling equipment, but he never fully exhausts its versatility, for new applications come to light daily.

In the plant of the Essex Engineering Co., Inc., a Jacobs No. 5 performs some unusually tough drilling operations, but its usefulness does not end there.

We show this Chuck doing a facing job on the bearings of a cast iron Spooling Attachment Frame that proves its design is mechanically correct and its gripping powers unusual. The closest tolerance limits are required on this work, but the Jacobs holds as steady as a miller.

Engineer W. H. Brutt of The Essex Works, states: "The Jacobs is most satisfactory for all around work."

This advertisement is published in the interests of good Drilling Equipment by the makers of the Jacobs Chuck

"Serve Well With Good Equipment"

The Die Head that Revolutionized Threading

You Buy
PRODUCTION *and* PRECISION

—not merely a tool—when you buy an H & G Self-Opening Die Head

A die head is only a means to an end—threads.

Thread production and precision have been revolutionized by H & G Self-Opening Die Heads.

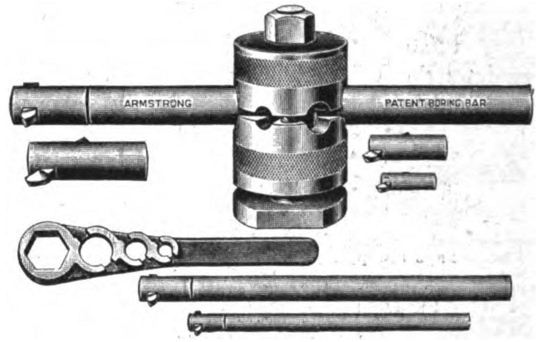
These die heads have established
—new standards of Accuracy
—new standards of Pieces per Day.
—new standards of Parts Threaded per Set of Chasers.

The new H & G catalog describes the entire line of H & G Self-Opening Die Heads, Threading Machines and Chaser Grinders.

Write for a copy.

THE EASTERN MACHINE SCREW CORPORATION
20-40 Barclay St., New Haven, Conn.

ARMSTRONG
THREE-BAR BORING TOOL



The many points of advantage of this lathe boring tool will be appreciated by practical machinists.

A slight turn of one nut releases or fastens both Bar and Holder.

Bars can be changed as needed almost instantly thus allowing the operator to use the stiffest bar possible for each job, with the result that speeds and feeds can be increased and time saved.

Write for catalog which shows our complete line of tool holders, ratchet drills, drop forged wrenches, lathe dogs, clamps, and other machine shop tools.

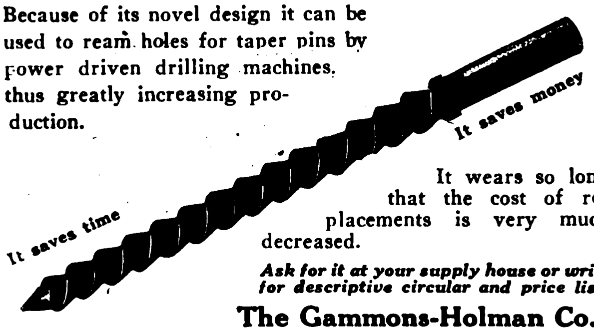
ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
315 N. Francisco Ave., Chicago, U. S. A.

W & B

The Whitman & Barnes Mfg. Co.
TWIST DRILLS & REAMERS
NEW YORK AKRON, OHIO. CHICAGO

The Gammons Taper Pin Reamer

Because of its novel design it can be used to ream holes for taper pins by power driven drilling machines, thus greatly increasing production.



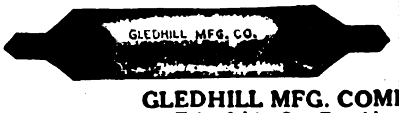
It wears so long that the cost of replacements is very much decreased.

Ask for it at your supply house or write for descriptive circular and price list.

The Gammons-Holman Co.
Manchester, Conn.

Gledhill Center Drills should be in every tool kit

Gledhill combination Center Drills are made from a special alloy steel. This assures great strength and superior cutting qualities.



Expert workmanship enhances accuracy and high speeds are possible without temper drawing. You need this Center Drill in your kit. Get the Circular for sizes and prices.

GLEDHILL MFG. COMPANY
107 Friendship St., Providence, R. I.

COWLES CUTTERS
FOR
INCREASED PRODUCTION
DURABILITY and ACCURACY
COWLES TOOL COMPANY
Cleveland, Ohio
Cutter Designers and Manufacturers

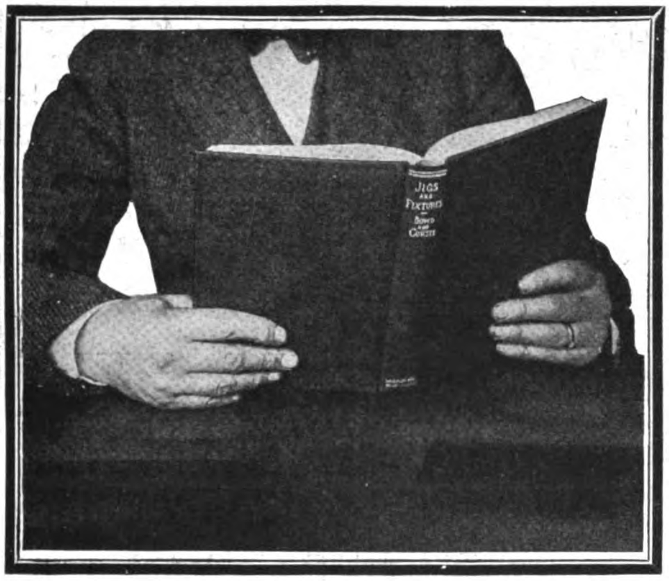
TRADE MARK
DELTA

DELTA FILES

FILES OF QUALITY

HIGHEST GRADE FILE MADE. THE FILE YOU WILL EVENTUALLY USE

DELTA FILE WORKS, Philadelphia



The New Science
of
Tool Engineering
applied to
Jigs and Fixtures

Here is the first of a series of three volumes completely covering the new science of tool engineering.

This first book deals with the design of jigs and fixtures based on the principles of tool engineering.

It takes up principles and their application to design, shows the reasons why certain methods are better than others, and gives many graphic examples which illustrate the use of the principles involved.

Published February, 1922

Tool Engineering—
Jigs and Fixtures

By Albert A. Dowd, President, Dowd Engineering Co.
and
Frank W. Curtis, Chief Engineer, Dowd Engineering Co.

293 pages, 6 x 9, 232 illustrations, $3.00 net, postpaid.

The man whose knowledge of tools is firmly grounded on sound mechanical principles is bound to be independent, original and progressive, and his designs, practical, economical and productive. This book, therefore, concentrates on and gives the reader a thorough knowledge of the underlying principles of jig and fixture design.

The book will be found useful because:

1. **The reasons why one design is better than another are clearly shown in numerous examples.**
2. **The authors have chosen these examples from actual cases observed during their long experience in handling production problems, both in the shop and the drafting room.**
3. **Actual problems are analyzed.**
4. **Causes of troubles are pointed out.**
5. **Correct and incorrect methods are illustrated.**
6. **Many valuable data are given regarding designs and proportions of jigs and fixtures for special work.**

Send for copy of the book and look up pages 180, 167 and 44. They alone will convince you of this book's value.

Free Examination Coupon

McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York, N. Y.

You may send me on 10 days' approval: Dowd and Curtis's Jigs and Fixtures, $3.00 net, postpaid. I agree to pay for the book or return it postpaid within 10 days of receipt.

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(Books sent on approval to retail purchasers in the U. S. and Canada only.) A. 12-28-22

"We wanted quick action—we got it"

¶ "We wanted to place an important contract in a hurry," they wrote.

¶ "We wanted a firm who could tool up quickly, and then could follow through consistently. We wrote to five firms advertising in the

Contract Work
Section of the
American Machinist

¶ "We made connections without difficulty, and we got quick action."

¶ And that's the way progressive firms will get together in 1923—through the Great Clearing House of American Specialty shops and plants with Surplus Facilities.

P.S. Are you making use of it?

The Everlasting Chair

That is what our all-metal chairs really are. They have pressed steel seats and backs, formed angle iron legs, heavy Bessemer rungs, and are put together with quarter-inch rivets.

They are light in weight, are finished in baked enamel, black or green, and cost but little more than wooden goods. Furnished with or without backs, 3 or 4 legs, 12- or 14-in. seats, and any height. Also with perforated wood seats as shown here.

METAL MEECO PRODUCTS

Fig. 504A

Leading concerns throughout the world have adopted them as standard.

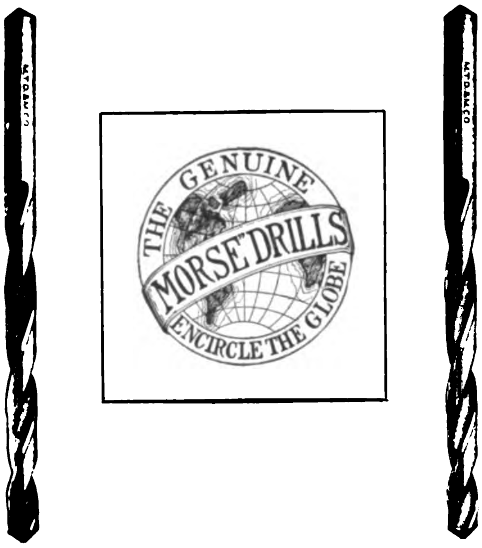
Write for catalog of our complete lines of metal shop and factory equipment.

Makers of Wash Bowls, Drinking Fountains, Lockers, Shelving, Tote Boxes, Work Benches, etc.

Manufacturing Equipment & Engineering Co.
Factory and General Offices:
FRAMINGHAM, MASS.
BOSTON NEW YORK

The Standard

Since 1864



MORSE
Twist Drill & Mach. Co.
New Bedford, Mass., U. S. A.

An Idea in Filing That Made Good!

In 1899 the idea that "ONLY THE BEST ARE GOOD ENOUGH" for the skilled American mechanic was responsible for the beginning of a new standard of precision file manufacture. From a small beginning the plant behind this idea has grown until today it supplies a wide and increasing circle of tool-makers and other precision workmen with

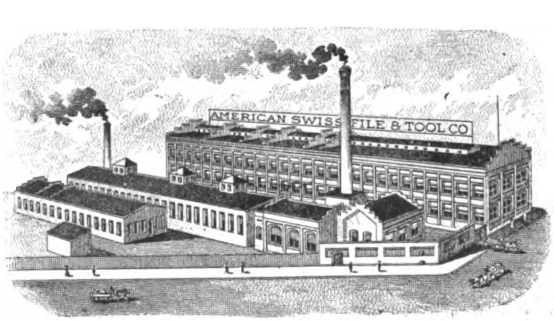
AMERICAN SWISS,

Files of Precision

Today the manufacturing plant below is devoted to making files of precision. Its service—and that of America's leading supply houses who carry "Stars & Cross" Files in stock—are the best solution to your own filing problem.

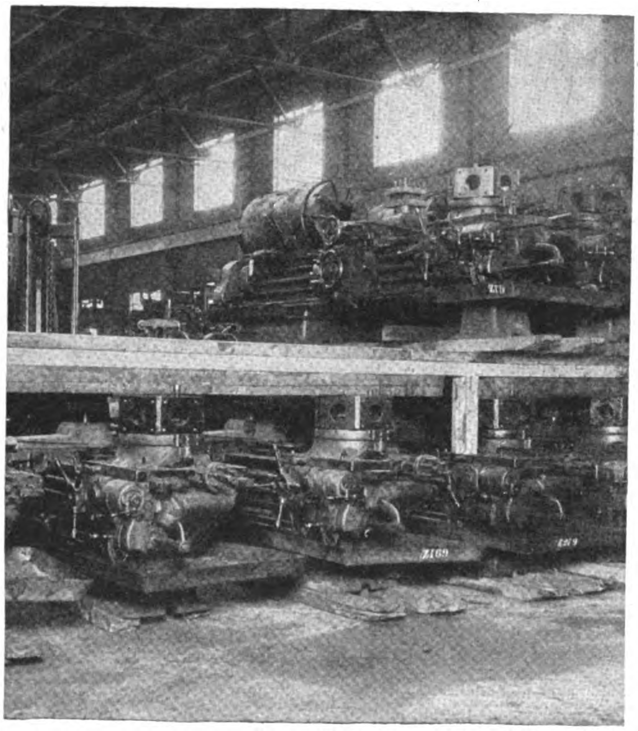
Start the new year RIGHT.
Order a trial box.

AMERICAN SWISS FILE & TOOL CO.
410-416 Trumbull St., Elizabeth, New Jersey



ReMANUFACTURED -(ORIGINATED BY US)- MACHINE TOOLS

REG. U. S. PAT. OFFICE



THIS is a part of a consignment of Libbey Turret Lathes which we have recently purchased from the Government. Some of them have never been set up. They are all to be ReManufactured, and offered to you at a fraction of their real value. We have hundreds of other bargains like these.

MILLERS

50—No. 6 Whitney.
59—Garragus.
3—No. 2 Pratt & Whitney.
22—No. 1 Van Norman.
61—No. 3½ Fox.
225—P. & W., Hendey, Becker, and Garvin, Lincoln Millers.
1—No. 13-B Browne & Sharpe.
1—No. 33 Kempsmith.
2—12-in. P. & W., Semi Aut.
7—Putnam, Semi Aut.
5—Briggs.
4—4-in. Pratt & Whitney Spline.
3—Pratt & Whitney Cam.
1—Beaman & Smith Open Back.
1—48-in.x10-ft. Newton, Duplex.
8—24-in. x 24-in. x 12-ft. Ingersoll Slab.
1—3-spdl. Beaman & Smith Slab.
1—No. 1 Brown & Sharpe, Vert.
3—No. 1½ Milwaukee, Vert.
2—No. 4-B Becker, Vert.
1—No. 3 Becker, Vert.
2—No. 2½ Milwaukee, Vert.
1—No. 3 Brown & Sharpe, Vert.
1—No. 3 Cincinnati, Vert.
1—No. 5 Becker, Vert.
1—No. AB Becker, Vert.
1—No. 5-B Becker, Vert.
8—No. 5-C Becker, Vert.
1—Style B Becker, Vert.
2—No. 6 Becker, Vert.

TURRET AND SCREW MACHINES

3—2-in. x 26-in. Pratt & Whitney.
2—2½-in.x26-in. P. & W., Gd. Hd.
3—3-in. x 36-in. Jones & Lamson.
2—3¼-in. x 36-in. Cincinn. Acme.
1—2-spdl. Jones & Lamson.
10—6-A Model 2 Potter & Johnston.
3—No. 8 Warner & Swasey.
2—No. 3-A Warner & Swasey.
2—21-in. Gisholt.
19—24-in. Gisholt.
26—24-in. Davis.
34—24-in. Steinle.
8—18-in. Libby.
18—26-in. Libby.

GRINDERS

2—No. 1 Morse.
1—No. 11 Ott.
2—No. 2 Fraser, Univ.
6—6-in. x 32-in. Norton.
1—No. 1 Bath, Univ.
1—6-in. x 20-in. Fitchburg.
1—10-in. x 36-in. Thompson, Univ.
12—10-in. x 36-in. Norton.
1—10-in. x 50-in. Norton.
3—10-in. x 72-in. Norton.
1—No. 2 Brown & Sharpe, Univ.
2—12-in. x 36-in. Fitchburg.
3—12-in. x 36-in. Modern.
5—12-in. x 36-in. Landis.
2—No. 3 Landis, Univ.
1—12-in. x 96-in. Landis.
1—12-in. 120-in. Landis.
1—14-in. x 36-in. Norton.
1—14-in. x 48-in. Queen City.
13—14-in. x 50-in. Norton.
5—14-in. x 72-in. Norton.
1—16-in. x 72-in. Norton.
1—20-in. x 96-in. Landis.
1—20-in. x 168-in. Landis.

RADIALS

3—3-ft. American, Sens.
4—4-ft. Carlton, Sens.
1—2-ft. American.
1—3-ft. Western.
1—3½-ft. Western.
1—4-ft. Western.
1—5-ft. Western.
1—6-ft. Western.

PRESSES

1—No. 15 Niagara Horn.
1—30-ton Lucas Forcing.
1—No. 61 V. & O. Str. Side.
6—No. 61 Stoll, Gd.
17—No. 56 Toledo, Gd.
1—No. 57 Toledo.
2—No. D. G. G. 56 Ferracute, Gd.
3—No. 58 Toledo.
1—No. 58 Toledo, Geared.
3—No. 87 Bliss, Gd.
1—No. 76½ Bliss, Gd.
1—No. 59 Toledo, Gd.

AUTOMATIC SCREW MACHINES

1—No. 00 Brown & Sharpe.
1—No. 2 Brown & Sharpe, Semi.
1—No. 2 Brown & Sharpe.
4—No. 75 National Acme.
3—2¾-in. Cleveland.
1—2-in. x 9-in. New Britain.

The Green List*

of Guaranteed ReManufactured Machine Tools

WRITE FOR A COMPLETE COPY

HORIZONTAL BORING MACHINES

3—Foote-Burt.
1—4-in. Niles.
1—4-in. Newark.
3—No. 1 Detrich & Harvey.
1—Beaman & Smith.
1—2-spdl Espen-Lucas.
1—No. 1, 3¾-in. Bar Barrett.
1—Rochester Floor Borer.
1—No. 3 Beaman & Smith.

VERTICAL BORING MACHINES

12—24-in. Bullard, New Era.
1—30-in. Gisholt.
1—34-in.-44-in. Colburn.
1—48-in. Colburn.
1—60-in. Bullard.
2—72-in. Cincinnati.

SHAPERS

1—14-in. Worcester.
1—15-in. Potter & Johnston.
1—16-in. Queen City.
1—16-in. Streine.
5—16-in. Walcott.
2—16-in. Steptoe.
1—16-in. Ohio.
2—20-in. Steptoe.
2—24-in. Walcott.
4—26-in. N. B. P.

**This is only a small part of The Green List.*
If the tools you want are not listed here, write and ask us.

HILL, CLARKE & CO OF CHICAGO
649 Washington Boulevard

LATHES

1—20-in. x 10-ft. Lodge & Shipley.
1—20-in. x 12-ft. Walcott.
3—20-in. x 12-ft. American.
3—20-in. x 16-in. American.
1—20-in. x 18-ft. Lodge & Shipley.
26—21-in. x 10-ft. Le Blond.
1—22-in. x 8-ft. L. & S., Gd.
1—22-in. x 10-ft. Lodge & Shipley.
2—24-in. x 10-ft. American.
1—24-in. x 10-ft. Amer., Gd. Hd.
1—24-in. x 10-ft. Hendey, Gd. Hd.
12—24-in. x 12-ft. Providence.
26—25-in. x 10-ft. Sidney.
8—25-in. x 10-ft. Le Blond.
17—25-in. x 12-ft. Le Blond.
4—26-in. x 10-ft. Walcott.
15—26-in. x 10-ft. Whitcomb-Blaisdell.
24—26-in. x 10-ft. Canada.
16—26-in. x 11-ft. Cisco.
13—26-in. x 11-ft. Wickes.
4—26-in. x 13-ft. Wickes.
1—26-in. x 12-ft. Walcott.
27—26-in. x 10-ft. Niles-Bement-Pond.
44—26-in. x 8-ft. Bridgeford.
175—26-in. x 10-ft. Bridgeford.
87—26-in. x 9-ft. Bridgeford.
19—26-in. x 12-ft. Bridgeford.
2—26-in. x 14-ft. Niles-Bement-Pond.
3—26-in. x 14-ft. Bridgeford.
6—26-in. x 16-ft. Bridgeford.
8—26-in. x 20-ft. Bridgeford.
4—30-in. x 11-ft. Amer. Gd. Hd.
4—30-in. x 11-ft. American.
2—30-in. x 11-ft. H. S. & G.
1—30-in. x 20-ft. Amer. Gd. Hd.
18—32-in. x 12-ft. Fitchburg.
1—32-in. x 12-ft. Wickes.
1—36-in. x 12-ft. Wickes.
3—36-in. x 14-ft. Johnson, Gd. Hd.
1—36-in. x 19-ft. Johnson, Gd. Hd.
1—36-in. x 20-ft. Putnam.
13—36-in.x30-ft. Pitts'bgh, Gd. Hd.
4—36-in. x 37-ft. N. B. P., Gd. Hd.
2—36-in. x 42-ft. LeBlond, Gd. Hd.
5—40-in. x 12-ft. Fifield.
2—45-in. x 24-ft. Pond, Gd.

PLANERS

1—24-in.x24-in.x24-in. Cincinnati. Crank.
1—24-in.x24-in.x12-ft. Whitcomb.
3—36-in.x36-in.x18-ft. Cincinnati, 2 hds.
1—42-in.x42-in.x9-ft. N.B.P.
1—48-in.x48-in.x12-ft. Cincinnati.
1—48-in.x48-in.x15-ft. Rockford.
1—48-in.x60-in.x10-ft. Gray.
1—96-in.x72-in.x20-ft. Bement, Miles.

DRILLS

15—14-in. Myers.
1—20-in. Excelsior, B. G.
4—22-in. W. F. & J. Barnes.
2—22½-in. W. F. & J. Barnes.
5—25-in. W. F. & J. Barnes.
2—25-in. Silver.
1—25-in. Barnes.
1—26-in. Barnes.
1—30-in. Barnes.
1—34-in. Barnes.
1—42-in. Cincinnati.
3—No. 1 Baker.
1—No. 310 Baker.
1—No. 315 Baker.
1—No. 513 Baker.
1—25-in., 2 spdl. Rockford.
1—3-spdl. Sigourney.
2—3-spdl. Taylor & Fenn.
3—4-spdl. Allen.
15—6-spdl. Allen.
1—No. 6-B Henry & Wright.
2—No. 11 Natco.
1—No. 11 Pratt & Whitney.
3—No. M-4 Natco.
2—No. 30 Natco.
1—No. 41 Natco.
3—No. 1 Barnes, Horiz.
1—Garvin Two Way Boring Mach.

MISCELLANEOUS

1—1500-lb. Erie Steam Hammer.
1—Cleveland Relieving Mach.
1—3½-in. Landis Sgle. Hd. Bolt Cutter.
3—No. 3 La Pointe Broaches.
1—No. 3 J. N. La Pointe Broach.
2—No. 4 La Pointe Broach.
1—Brown & Sharpe Polishing & Finishing Machine.
1—No. 0 Mitts & Merrill Keyseater.
70—Newton, Betts, Pratt & Whitney, and Garvin Profilers.
1—4-in. Whiton Centering Mach.
1—Whiton Center. Mach. (7 in.)
18—Pilton Slotters.
1—Richert & Shaefer Tapper.
1—Oliver Filing Machine.
1—3-in. Hurlbut & Rogers Cut Off.
1—No. 4-B Dreis & Krump Hand Brake.

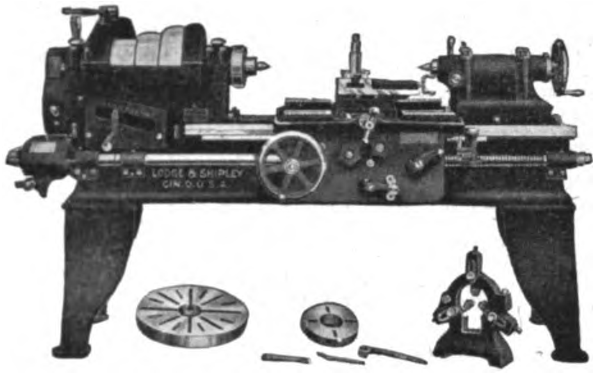
FOR SALE! Complete Equipment

Exceptional opportunity to purchase—Modern Machine Tools, Raw Materials, Supplies, etc.

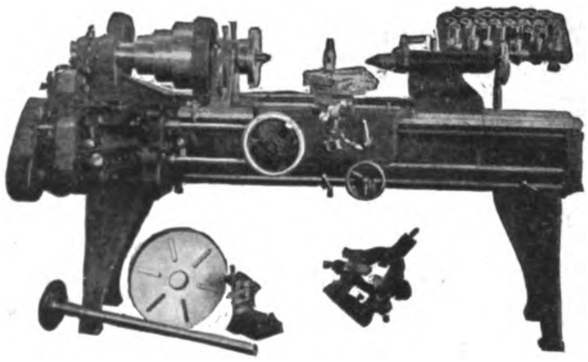
Becker Milling Machine Co., 110 Business St., Hyde Park, Boston, Mass.
Tel. Hyde Park 800

Whitcomb-Blaisdel. Mch. Tool Co., 677 Cambridge St., or 134 Gold St., Worcester, Mass.
Tel. Park 4940

Business and Goodwill purchased by REED-PRENTICE CO., Worcester, Mass.



3—18 in. Lodge & Shipley Engine Lathes, Compound Rest, Double Back Gears, Quick Change; similar to cut.



2—16 in. Pratt & Whitney Engine Lathes, Compound Rest, Quick Change, Chuck, Taper Attachment. One machine with collet attachment and 6 collets; similar to cut.

84 Engine Lathes, Cone and Geared Head

Lodge & Shipley, Hendey, Pratt & Whitney, LeBlond, Reed-Prentice, Whitcomb-Blaisdell, Flather, Champion, Boye & Emmes.

16 Turret Lathes

Potter & Johnston, Gridley, Pratt & Whitney, Gisholt.

6 Automatic Screw Machines

Cleveland, Gridley, Pratt & Whitney.

22 Planers

22 in., 24 in., 26 in., 30 in., 36 in., 42 in.

Whitcomb-Blaisdell, Pond, Woodward & Powell, Cincinnati, Gray, Fitchburg.
Also one 60 in. x 60 in. x 14 ft. Gray, late type, two rail heads, two side heads, worm drive.

40 Millers, Plain, Universal, Vertical

Kempsmith, Milwaukee, Becker, Van Norman. Also Becker Planer Type and Duplex.

26 Drills Upright and Multiple Spindle

Sigourney, Snyder, Prentice, Henry & Wright, Blaisdell.

19 Grinders, Plain Cylindrical and Universal

Brown & Sharpe, Landis, Norton.
Also surface, cutter, tool, internal and bench grinders.

12 Gear Cutters

Brown & Sharpe, Gould & Eberhardt, Fellows, Winton, Schuchardt & Schutte.

8 Boring Machines, Horizontal and Vertical

Universal, Niles, Lucas, Beaman & Smith, King, Colburn.

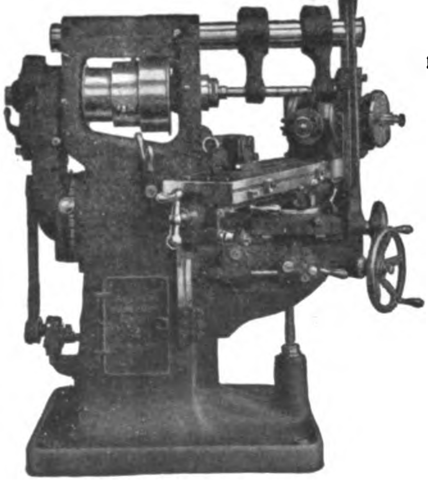
Miscellaneous Machine Tools

Arbor Presses, Shapers, Metal Saws, Centering Machines, Punches and Shears, also woodworking equipment.

Raw Material and Supplies

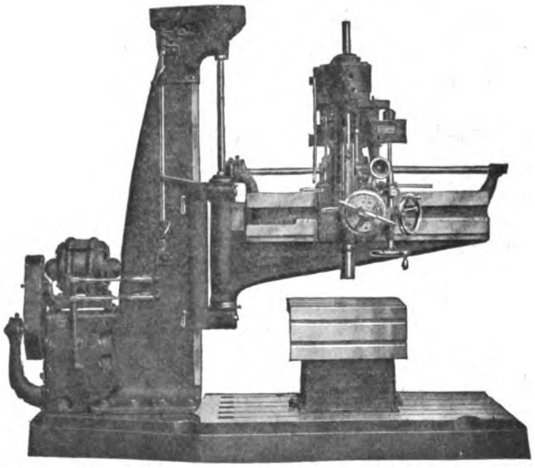
Cold Rolled, Machinery, High Speed and Tool Steel. Twist Drills, Emery Wheels, Belting, etc.

Cutters of all Descriptions



1—No. 2 Becker Universal Milling Machine, with 12 in. Dividing Head, Tailstock, Pumps, all power feeds, range 28 in. x 14 in. x 18 in., working surface of table 43 in. x 10 in., arranged for motor drive. (Reliance 110 volt D. C. 1½ h.p., 300 - 1600 r. p. m. motor). Similar to cut.

1—4 ft. Reed-Prentice Radial Drill, ball bearing type, box table 22 in. x 20 in. x 20 in., arranged for motor drive. Similar to cut.



Land and buildings of Becker Milling Machine Co. and Whitcomb-Blaisdell Machine Tool Co. for sale. Detailed description of buildings, plans and prices sent on request. Apply Treasurer at 677 Cambridge St., Worcester, Mass., or Tel. Park 4940.

NEW AND SLIGHTLY USED MACHINE TOOLS

DRILLS

1—No. 3 (used) two spindle Detroit High Speed Ball Bearing drill, plain table in first class condition.
3—14 in. U. S. floor type, wheel and lever feed, square and round tables, cup and crotch centers, countershaft.
2—21 in. Cleveland stationary head, wheel and lever feed only, back gears, round table, square base, tight and loose pulley drive.
2—22½ in. Cleveland upright stationary head, back gears, power feed, automatic stop, round table, square base, tight and loose pulley drive.
2—23½ in. Cleveland stationary head, back gears, power feed, round table, square base, tight and loose pulley drive.
7—26 in. Cleveland upright, stationary head, back gears, geared power feed, automatic stop, round table, square base, tight and loose pulley drive, with tapper.
2—28 in. Kern, sliding head, back gears, power feed, automatic stop, round table, square base, tight and loose pulley drive.
2—32 in. Kern, sliding head, back gears, power feed, automatic stop, round table, square base, tight and loose pulley drive.
1—REED BROS. (Barr), 4 spindle, Style B, plain bearing, sensitive type, 14 in. swing, hand lever feed, regular equipment.

PRESSES

2—No. 10 Lebanon foot presses.
3—No. 0 Arbor presses.
4—No. 1½ Arbor presses, bench type.
10—No. 2 Arbor presses.
4—No. 3 Arbor presses.
1—No. 3-A Arbor press.
2—No. 4 Arbor presses.
1—No. 5 Arbor press.
1—No. 28 Arbor press, floor type.
1—Thirty ton Perfection Arbor press, (used).

POWER PUNCH PRESSES

1—No. 5½ (used) Bliss Consolidated open back inclinable flywheel type, wrenches, bolster plate.
2—No. 3 Loshbaugh-Jordan open back, inclinable flywheel type.
No. 4 Loshbaugh-Jordan open back inclinable flywheel type.
1—No. 5-A Williard open back inclinable flywheel type.
1—Lourie Hydraulic press, 40 tons cap. (used).

GRINDERS

3—Drill grinders, capacity ⅛ in.-1½ in., floor type, single holder, dry, with countershaft.
1—Drill grinder, capacity ¼ in.-2½ in., floor type, single holder, dry.
2—Drill grinders, capacity ¼ in.-2½ in., floor type, single holder, wet.
1—Drill grinder, complete with drill grinding attachment on one end and thinning wheel on the other, countershaft and all regular equipment, capacity ¼ in.-2½ in.
4—No. 2 Reid Bros. surface grinders, feeds: Longitudinal feed automatic, 18 in.; Cross automatic, 6 in.; Vertical feed 11½ in., with countershaft and equipment.
3—No. 1 Wilmarth & Morman surface grinders, Longitudinal feed, 15 in., cross feed, 7 in., vertical table movement, 10 in. (all hand).
1—No. 1 Norton cutter and reamer grinder, complete including single speed countershaft, swivel head stock, 5 wheels, but no regular attachments.
1—No. 2 Norton Universal Cutter and Reamer grinder, complete with all regular attachments including countershafts and wrenches.
1—No. 1 Wilmarth & Morman Universal Cutter and Reamer Grinder, complete with all regular attachments equipped with power feed, countershafts and wrenches.
1—No. 2¼ Webster & Perks, plain bearing, floor type grinder with Hyatt roller bearing C.S. Size of wheel, 30 in. x 4 in.
1—No. 1¼ Webster & Perks, plain bearing, floor type grinder with Hyatt roller bearing C.S.
1—No. ¾ Webster & Perks, plain bearing, floor type, square pedestal with countershaft and 12 in. plain wheel guard. Size of wheel, 8 in. x 1 in.
1—No. 1 Webster & Perks, electric grinder, floor type, with 1 hp., 220 v., 3 ph., 60 cy. motor and plain wheel guards. Size of wheel, 10 in. x 1½ in.
1—8 x 18, 1—8 x 30 and 1—12 x 36 (slightly used) Modern Plain Cylindrical Grinders, with Factory Guarantee Complete with all equipment.
1—No. 3 (13 in. x 40 in.) Slightly used Modern Universal Cylindrical Grinder with Factory Guarantee. Complete with all equipment.
1—No. 2 Used Brown & Sharpe cutter grinder.

LATHES

2—No. 100 Wells speed lathes, 11ft. x 4 ft. with countershafts.
3—Blount 11 in. x 4 ft. speed lathes and countershafts.
1—12 in. x 5 ft. Worcester semi-quick change gear, engine lathe, three step cone pulley, single back gear.
1—14 in. x 6 ft. (Cisco), three step cone, double back geared engine lathe, complete with all regular equipment.
1—(Used) 14 in. x 6 ft. Whitcomb-Blaisdell lathe, three step cone, pulley belt drive double back geared, quick change gears; fair condition.
3—16 in. x 6 ft. (used) Whitcomb-Blaisdell engine lathe with three step cone, double back gear, four sided turret tool post on cross slide, steady rest, countershaft, used machine.
1—16 in. x 10 ft. Cisco engine lathe, three step cone, double back gears, quick change gear, countershaft, wrenches and all regular equipment.
1—18 in. x 8 ft. Cisco engine lathe three step cone, double back geared, quick change gear, steady rest, countershaft, wrenches and all regular equipment.
1—20 in. x 11 ft. Chard engine lathe, quick change gear, double back geared, three step cone, countershaft and all regular equipment.
1—20 in. x 10 ft. Wickes engine lathe, quick change geared, three step cone, double back geared, countershaft, wrenches and all regular equipment.
1—20 in. x 8 ft. (used) Davis engine lathe, actual swing, 22 in.; three step cone for 4 in. belt, double back geared, hollow spindle, machine fitted with pan bed, fair condition, needs some overhauling.
2—21 in. x 10 ft. (used) Le Blond heavy duty, quick change gear, screw cutting engine lathe, three step cone pulley belt drive, double back gears, power cross and longitudinal feed, equipped with taper attachment, compound rest, large and small face plates, center rest, countershaft, chucks, wrenches, etc.
1—24 in. x 13 ft. Chard engine lathe, quick change gear, double back geared, four step cone, complete with countershaft and all regular equipment; actual swing, 26 in., distance between centers, 54 in.; hole through spindle, 2¼ in.
1—24 in. x 10 ft. Advance engine lathe, three step cone, pulley belt drive, double back gear, quick change gears, complete with all regular equipment, double friction and countershaft.
1—72 in. x 46 ft. Fifield engine lathe, (used) standard triple geared, standard pattern, gear head, complete with two carriages, taper attachments and hollow bored spindle, also 1 50 hp., 220 v., d.c. G. E. motor, frame BA with T-94 drum controller and CR 3221 Resister.
1—16 in. (used) Dreses, plain turret lathe, friction geared head with countershaft, no cut-off slide.
1—(Used) Meriden Turret Lathe, plain head, with countershaft, no cut-off slide.
1—No. 11 (used) Garvin screw machine with collets, ⅛ in., ¼ in., and $\frac{5}{16}$ in., complete with wire feed, cut-off slide, countershaft, and all regular equipment; in first class condition.
1—20 in. (used) Steinle turret lathe, actual swing, 22 in.; fitted with three jaw Universal chuck, spindle has 4¼ in. hole.. Machine is in first class working condition.

SAWS

1—(Used) Lee Simple Cold Saw No. 15. Capacity 5½ in. round stock, 5 in. square stock, 9 in. I beam or flat, single pulley drive machine; no countershaft.
1—6 x 6 Starrett Hack Saw with floor pan and attachment.

BAND SAWS

7—Napier 10 in. x 10 ft. Horizontal Metal cutting machines, arranged belt drive.

MILLING MACHINES

2—No. 2 Cleveland Plain Milling machine, single pulley drive, complete with 1¼ in. arbor, machine fitted with No. 11 B & S taper.
3—No. 1-A Fox plain millers, back geared, auto. long. feed, hand cross vert. feed, cone drive, countershaft, and all regular equipment.
2—No. 2B Fox plain milling machines, complete with countershafts and all regular equipment. Power longitudinal feed. Surface 8½ in. x 24 in.
2—O-B Fox plain millers, long. feed (power) 17¼ in.; cross feed (hand) 3½ in.; vert. feed (hand) 5¾ in.; cone drive, double feed with countershaft and all regular equipment.

MILLING MACHINES (continued)

1—(Used) No. 2 Beaman & Smith Horiz. Spindle drilling, boring and milling machine, motor driven with 1 Reliance variable speed d.c., 6 hp., motor for driving spindle and 1 variable speed d.c., 2 hp. motor for feed and operating head up and down the column back and forth with E. C. and M. control.
1—No. 4 LeBlond Plain Heavy Duty Milling Machine, Power Feeds in all directions. Oil pump and connections. Equipped with 10 hp. variable speed, d.c. Jantz & Leist motor, 500 to 1500 r.p.m.
1—No 4 LeBlonde Milling Machine, power feeds in all directions. Variable speed, 6 hp., d.c. motor drive

SHAPERS

3—16 in. Milwaukee back geared, crank shapers, with swivel tables, swivel vises, cone drive, countershafts and all regular equipment.
1—16 in. Bertschy Mattison back geared crank shapers, complete with vises, countershafts and all regular equipment.
2—20 in. Milwaukee back geared crank shapers, with swivel tables, swivel vises, cone drive, countershafts and all regular equipment.
2—24 in. Milwaukee back geared crank shapers, with swivel tables, swivel vises, cone drive, countershafts and all regular equipment.

BORING MILLS

2—48 in. Colburn Std. Pattern with 2 swivel or 1 swivel and 1 fixed turret head. Belt and motor drive, plain table and all regular equipt.
1—54 in. Colburn Std. Pattern with 2 swivel or 1 swivel and 1 fixed turret head. Belt and motor drive. Plain table and all regular equipment.
2—72 in. Colburn Std. Pattern with 2 swivel or 1 swivel and 1 fixed turret head. Belt and motor drive. Plain table and all regular equipment.

PLATE SHOP TOOLS.

1—No. 2 Hilles & Jones single punch, 36 in. throat depth, capacity 1 in. thru ⅞ in. or to shear ¾ in. plate.
1—No. 3 (used) single punch, 25 in. throat depth, capacity 1¼ in. in 1 in.
1—No. 4 Single punch, 48 in. throat depth, capacity 1½ in. thru 1 in. or will shear 1½ in. plate.
1—No. 5 Double end punch or coper, (used) 20 in. throat depth one end and 22 in. other end. Capacity 2 1 in. holes in 1 in. and for 24 in. standard sections.
2—No. 2 Horizontal punch, 12 in. throat depth, capacity 1 in. thru 1 in.
1—No. 2 Horizontal punch, 12 in. throat depth, capacity, 1 in. diameter, thru 1 in. (used).
1—No. 3 (used) Horizontal punch, 12 in. throat depth, capacity 1¼ in. diameter, thru 1 in.
1—No. 3 Guillotine frame bar shear, 16 in. blades for flat or square bars, capacity 2½ in. square, 10 in. x 1¼ in. flats, 3 in. rounds.
1—No. 4 Double Guillotine Bar Shear mounted on 10 ft. blades for flat or square bars, capacity designed for 4 in. square hot bars, 3½ in. cold square, 12 in. x 1½ in. flats, 4 in. round.
1—No. 2 Rotary Bevel shears, cap. ¾ in. plate.
1—No. 4 Double angle shear mounted on 10 ft. diameter turn table, capacity, 8 in. x 8 in. x 1 ft. angles. (Used).
1—No. 3 Gate shear (used). Distance between housings 134 in., throat depth of housings, 31 in., ¼ in. plate.
1—No. 6¼ Gate shear (Used). 66 in. between housings, 36 in. throat depth, capacity, 60 in. of 1 in. plate.
1—No. 4 Plate straightening rolls, distance between housings, 128 in. 6 14 in. rolls.
1—No. 4 Plate straightening rolls, distance between housings, 86 in. 6 14 in. rolls. Capacity 84 in. of 1 in. plate.
1—"A" roller leveller. Distance between housings, 42 in. or 48 in. if preferred. 18 2¾ in. dia. rollers. Capacity No. 18 and No. 29 sheets cold.

MISCELLANEOUS

1—(Used) 2000 lb. Bennington scale.
1—⅝ in. Rickert & Shafer horizontal bench tapping machine, complete as regularly furnished.
1—No. 2 Mitts & Merrill little giant keyseating machine complete with all standard equipment, including countershaft, 1¼ in. arbor and set of cutters.
1—No. 732 Greenfield bolt threading machine, capacity ¼ to ½, ⅝ to 1 in. dies (Pipe), for the above, complete with countershaft, all regular equipment.
1—6 in. Wallace Bench wood jointer, 110 v., a.c., single phase motor.
1—No. 3 Barry Die Filing machine, floor type, belt driven, countershaft right on the machine.
1—4 in. Wallace Bench wood jointer, complete with motor, 110 v., direct current.
1—No. 18 Lennox throatless shear.
1—No. 1 Robinson Bench Filing machine.

CONSOLIDATED MACHINE TOOL CORPORATION of AMERICA

Plants:
Betts Machine Plant, Rochester, N. Y. (Phone: Chase 4600)
Modern Tool Plant, Erie, Pa. (Phone: Bell 2150)
Hilles & Jones Plant, Wilmington, Del. (Phone: Wil. 4230)
Newton Mach. Tool Plant, Phila., Pa. (Phone: Locust 0125)
Colburn Mch. Tool Plant, Cleveland, O. (Phone: Eddy 4082)

GENERAL OFFICE:
17 E. 42nd St., New York
(Phone Vanderbilt 3930)

District Offices:
Pittsburgh, 1915 Oliver Bldg. (Phone: Grant 424)
Philadelphia, 23rd and Vine Sts. (Pohne Locust 0125)
St. Louis, 1956 No. Broadway (Phone: Tyler 747)
Chicago, Ill., 541 W. Washington Blvd. (Franklin 1242)
Cleveland, O., 1038 Ivanhoe Road (Eddy 4082)

SECOND-HAND MACHINE TOOLS

DRILLS

1-spindle Avey ball bearing.
3-spindle Henry & Wright ball bearing.
3-spindle Taylor & Fenn.
4-spindle Francis Reed.
20-in Prentice Br. slid. hd. B.C., P.F.
28-in. Snyder, sl. hd., B.C., P.F.
32-in Superior, sl. hd., B.G., P.F.
42-in. Cincinnati-Bickford sl. hd., B.G., tap. att.
No. 17 4-spdl. Foote-Burt gang drill.
No. 30 Bausch multiple spindle.
3-ft. Cincinnati Bickford plain radial, tap. att.
3-ft. No. 0 Bickford plain radial, tapping att.
3-ft. Mueller plain radial, tapping att.
3-ft. American plain radial.
5-ft. Dresee plain radial, tapping.

LATHES

9-in. x 20-in. Porter Cable mfg. lathe.
12-in. x 6-ft. Hendey Lathe, C.R., P.C.F., Q.C.
14-in. x 6-ft. Hendey Lathe, C.R., P.C.F., Q.C.
14-in. x 6-ft. Monarch C.R., P.C.F., Q. C. G.
14-in. x 8 ft. Lodge & Shipley C.R., P.C.F., Q.C.G.
16-in. x 8-ft. Champion, C.R., P.C.F., Q.C.G.
16-in. x 8-ft. Lodge & Shipley, geared hd., C.R., P.C.F. taper att. Longitudinal and cross feed stops.
17-in x 8-ft. Flather, C.R., P.C.F., Q.C.G.
18-in. x 8-ft. Greaves-Klusman, C.R., P.C.F., Q.C.G.
18-in. x 8-ft. Whit.-Blaisdell, C.R., P.C.F., Q.C.G.
20-in. x 8-ft. American, C.R., P.C.F
24-in.x14-ft. Greaves-Klusman, C.R., P.C.F., Q.C.
32-in. x 14-ft. Hamilton, C.R., P.C.F., triple geared.
38-in. x 16-ft. Pond, geared head, C.R., P.C.F., triple geared, arr. M.D.

BORING MACHINES

No. 1 Lucas table type, hor. bor. & drilling mach. 3-in. bar.

BORING MACHINES (Cont'd)

No. 2 Beaman & Smith floor type, arr. M.D., 4-in. bar.
34-in. Colburn, turret head, vertical.
38-in. Niles, 2 reg. heads, vertical.
51-in. Niles 2 reg. heads, vertical.

SCREW MACHINES AND TURRET LATHES

⅜-in.-½-in. cap. Cleveland auto. Model A screw machine.
⅝-in.-⅞-in. cap. Cleveland auto. Model A screw machine.
½-in. cap. Cleveland pl. auto. Model B screw machine.
1-in. cap. Cintl.-Acme wire feed screw machine.
1¼-in. cap. Cintl.-Acme wire feed screw mach.
1½-in. cap. Cintl.-Acme wire feed screw mach.
2½-in. cap. Cintl-Acme wire feed screw mach.
16- and 18-in. Cintl.-Acme univ. Fox turret lathe.
2¼-in. x 24-in. Jones & Lamson, bar or chucking turret lathe.
3¼-in. x 36-in. Jones & Lamson, bar or chucking turret lathe.
No. 1-B Foster geared head turret lathe.

MILLERS

No. 2, 3 and 4 Cincinnati plain.
No. 5 Cincinnati plain hp.
No. 2B Brown & Sharpe plain.
No. 2, 5 and 9 Kempsmth plain.
No. 3 and 4 Cincinnati vertical.
No. 2A, C-2, 4B and 5 Becker vertical.
No. B2 Becker continuous type vertical.
No. 1½, 3 and 3S Cincinnati universal.
No. 1½ Brown & Sharpe universal.
36-in. x 10-ft. Newton, face slab type.
4½-in. x 12-in. Pratt & Whitney thread milling machines.

GRINDERS

3-in. x 18-in. Norton plain.
6-in. x 32-in. Norton plain.
10-in. x 36-in. Norton plain.

GRINDERS (Cont'd)

10-in. x 30-in. Landis plain.
12-in. x 120-in. Landis plain.
16-in. x 52-in. Landis plain crankshaft grinder.
12-in. x 40-in. B&S universal.
12-in. x 36-in. Cincinnati universal.
2-12-in. x 24-in. Diamond surface.
Taylor high-speed water tool grinder.
No. 1 Cincinnati cutter and reamer grinder.
No. 60 Heald cylinder grinder.
No 11 Rivett Ball Race, with power oscillating att.
Saxon face grinder.
10-in. Garrigus rotary, with magnetic chuck.
No. 2 Brown & Sharpe surface grinder.
18-in. and 20-in. disc grinders.

SHAPERS AND PLANERS

14-in. Gould & Eberhardt crank shaper, B.G.
20-in. Davis crank shaper, back geared.
24-in. Stockbridge crank shaper, back geared.
15-in. and 24-in. Hendey friction shapers.
24-in. x 24-in. x 6 ft. Flather planer, 1 hd.
36-in. x36-in. x 12-ft. Pond planer, 2 hds.
48-in. x 48-in. x 15-ft. Sellers planer, 3 hds.
60-in. x 40-in. x 12-ft. Pond planer, 2 hds.
66-in. x 60-in. x 30-ft. Bement planer, 3 hds.
96-in. x 60-in. x 12-ft. Detrick & Harvey open-side convertible planer, 4 hds., M.D.

MISCELLANEOUS

No. 3 Lapointe broaching machine.
No. 72 Ferracute press.
No. 13 P & W profilers.
36-in. Gould & Eberhardt gear cutter.
36-in. B & S gear cutter.
18-H Gould & Eberhardt hobbing gear cutter.
¾-in. x ¾-in. single end punch and shear.
6-in. Gleason bevel gear generator.
American and Stewart furnaces.
Newton, Burr and Racine Saws.
Bliss & Adriance power presses.
30-Ton Lucas Forcing Press.

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HENRY PRENTISS & COMPANY,
149 BROADWAY, NEW YORK, N. Y.

BOSTON BUFFALO HARTFORD SYRACUSE ROCHESTER

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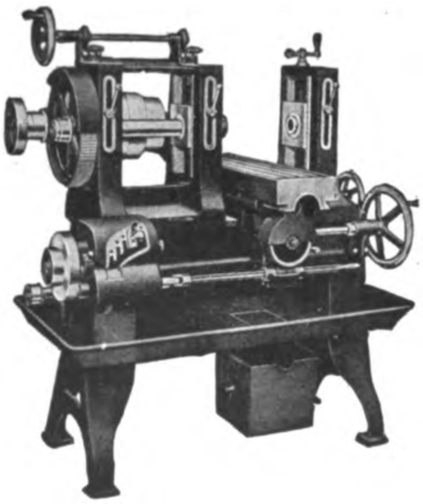
100 Hendey No. 4
Lincoln Type Millers



SPECIFICATIONS

Longitudinal feed (power), 20 in.
Cross feed, 5 in.
Vertical adjustment of spindle, 8 in.
Size of table 24 in. x 6 in. (2—⅝ in. T slots).
Greatest distance between spindle and table 9 in.
Number of feed changes, 12
Taper hole in spindle, B. & S. No. 10
Speed of countershaft, 200 r.p.m.
Weight, about 2,200 pounds.

LOOK

Some
Bargain

Your choice of either a

Hendey or Becker
Lincoln Type Miller

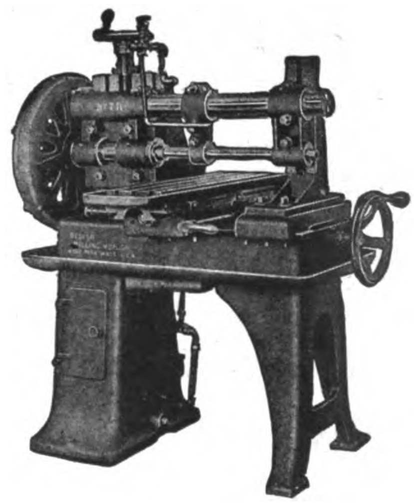
$125.00 Each

F.O.B. cars Newark, N. J.

Each machine nearly new and guaranteed in A-1 condition and complete with countershaft and oil pump but no arbor.

Terms 1/3 with Order. Balance Sight Draft against Bill of Lading

200 Becker No. 7-H
Lincoln Type Millers



SPECIFICATIONS

Longitudinal feed (power), 19½ in.
Cross feed, 7 in.
Vertical adjustment of spindle, 9 in.
Greatest distance between spindle and table, 9½ in.
Size of table 29 in. x 9 in. (3—⅝ in. T slots).
Number of spindle speeds, 3
Taper hole in spindle, B. & S. No. 10
Speed of countershaft, 160 r.p.m.
Weight, about 2,400 pounds

New Jersey Machinery Exchange, 21 Mechanic St., Newark, N. J.

127-131 N. Third St.

FRANK TOOMEY, Inc.

Philadelphia, Penna.

LATHES

1—13-in. x 5-ft. 6-in. Carroll-Jamieson.
2—14-in. x 5-ft. Hendey Q.C.G.
1—14-in. x 6-ft. 8-in. and 10-ft. Carroll-Jamieson, Q.C.G.
1—15-in. x 6-ft. and 8-ft. Sidney Q.C.G., D.B.G.
1—15-in. x 6-ft. Davis Tool Room, Taper & Relieving Attachment.
1—18-in. x 10-ft. Boye & Emmes, Q.C.G., D.B.G.
2—17-in. x 8-ft. and 10-ft. Sidney, Q.C.G., D.B.G.
3—19-in. x 8-ft.-10-ft. and 12-in. Sidney, Q.C.G., D.B.G.
1—25-in. x 12-ft., 14-ft. and 16-ft. Sidney, Q.C.G.-D.B.G.
1—35-in. x 16-ft. and 18-ft. Sidney, Q.C.G., D.B.G.
1—18-in. x 14-ft. Reed Pl. Change Taper Att.
1—16-in. x 6-ft. Economy, Q.C.G., D.B.G.
1—18-in. x 8-ft. Boye & Emmes, Q.C.G., D.B.G. Taper Att.
2—18-in. x 8-ft. Wolcott, Q.C.G., D.B.G.
1—18-in. x 8-ft. Wolcott, Pl. Chg. Taper Att.
5—18-in. x 8-ft. Whitcomb-Blaisdell, Q.C.G., D.B.G.
1—34-in. x 24-in. Putnam Triple Geared, Motor driven, Taper Att., C.R-P.C.F. 2—C.G.-D.B.G. 2-in. Hollow Spindle, 32-in., 4-Jaw Indpt. Chuck fitted.
1—36-in. x 24-ft. Putnam, same as above.
1—64-in. x 38-ft. Putnam, Motor Driven, Triple Geared, Q.C.G., Taper Att., 2½-in. Hollow Spindle, C.R.-P.C.F., complete and equipped with 20-hp., D.C., 220-v. Motor. (Will change motor to suit purchaser.)
1—18-in. x 10-ft. Sidney, Geared Head, Motor Drive, Q.C.G., D.B.G.
1—14-in. x 8-ft. Sidney, Q.C.G., D.B.G.

PLANERS

24-in. x 24-in. x 6-ft. Whitcomb, 1 hd., belt drive.
24-in. x 24-in. x 6-ft. Amer., 1 hd., belt drive.
24-in. x 24-in. x 6-ft. Pease, 1 hd., belt drive.
24-in. x 24-in. x 8-in. Hendey, 1 hd., belt drive.
30-in. x 30-in. x 6-ft. Pease, 1 hd., belt drive.
30-in. x 30-in. x 8-ft. New H. 1 hd., belt drive.
30-in. x 30-in. x 10-ft. Dustin, 1 hd., belt drive.
30-in. x 30-in. x 10-ft. Cleveland, Open Side, 2 hd., motor drive.
36-in. x 36-in. x 10-ft. Cincinnati, 3 hd., motor drive.
36-in. x 36-in. x 14-ft. Ohio Planer head.
44-in. x 44-in. x 12-ft. Cleveland, Open Side, 3 hd., motor drive.
48-in. x 48-in. x 16-ft., 3 hd., belt drive.

SHAPERS

1—14-in. Davis.
1—16-in. Whip.
3—16-in. Steptoe, Belt Drive.
3—16-in. Steptoe, Motor Drive.
1—20-in. Smith & Mill.
3—24-in. Steptoe, Belt Drive.
1—24-in. Steptoe, Motor Drive.

MILLERS

1—No. 0 Steptoe, plain, power feeds.
1—No. 11 Garvin, plain.
1—No. 3½ Fox, plain.
1—No. 1 Bickford, plain.
2—No. 16 Whitney, plain.
1—No. 1 Dow, plain, power feeds.
2—No. 2 Cleveland Universal, high power, single pulley.
1—No. 2 Le Blond, plain, power feeds.
1—No. 2-A Brown & Sharpe, Univ., sgle. pulley.
1—No. 2 Owen Universal, power feed.
1—No. 3 Cincinnati, Universal, power feed.
1—No. 4 Brown & Sharpe, plain, power feeds.
1—No. 4 Cincinnati, plain, high power.
2—No. 2 Brown & Sharpe, Vert., power feeds.
1—No. 22 Garvin, Vertical, power feeds.
1—No. 6 Becker, Vertical, power feeds, late type.
1—No. 2 Garvin, plain power feeds.
2—No. 2 Cleve. Univ., high power, sgle. pulley.

GRINDERS

1—No. 1 Le Blond Universal Tool and Cutter.
1—No. 2½ Walker Surface Grinder with magnetic chuck.
2—Greenfield Tool and Cutter.
1—No. 1 Fraser Universal.
1—No. 3 Brown & Sharpe Cutter and Reamer.
1—10-in. x 36-in. Norton, plain.
1—10-in. x 40-in. Norton, plain.
1—10-in. x 50-in. Norton, plain, with camshaft attachment.
1—14-in. x 96-in. Norton, plain.
Wet Tools and Double End Grinders, all types.
1—No. 60 Heald, all attachs., Serial No. 2113.
1—12-in. x 66-in. (No. 4) Landis, Universal.

DRILLS

4—10-in. Buffalo Sensitive, bench.
6—15-in. Buffalo Sensitive, floor.
6—14-in. Excelsior Sensitive, floor.
10—14-in. U. S. Sensitive, floor.
15—20-in. Champion B.G., P.F.
1—21-in. Aurora, B.G., P.F. Tapping Att.
1—21-in. Superior, B.G., P.F.
1—24-in. Prentice, Sliding Head, B.G., P.F.
1—28-in. Rockford, Sliding Head, B.G., P.F.
1—32-in. Superior, Sliding Head, B.G., P.F.

DRILLS (Cont.)

1—36-in. Superior, Sliding Head, B.G., P.F.
1—Single Spindle Foote-Burke, Heavy Duty.
1—Single Spindle Baker, Heavy Duty.
1—4-Spindle Kokomo, Sensitive.
1—Single Spindle Kokomo Sensitive.
1—6-Spindle Allen Sensitive.
1—4-ft. Bickford, Plain Gear, box drive.
1—5-ft. Niles, Universal, gear box.
5—5-ft. Bausch, Universal, motor drive.
1—7-ft. Fosdick, plain, belt drive.

BORING MILLS

2—42-in. Bausch, Vertical, 2 hds., motor drive.
1—42-in. Bullard, Vertical, 2 hds., belt drive.
2—No. 1 Cleveland, Horiz., 2½-in. bar, sgle. pulley.
1—Universal 3-in. bar.
1—42-in. Pond Wheel, motor driven.

GEAR CUTTERS

1—No. 3 36-in. Brown & Sharpe, Spur.
1—No. 18 Brown & Sharpe, Spur and Bevel.
5—No. 6 Bellows Gear Shapers.

SCREW MACHINES

1—1-in. Smurr & Kamen, wire feed.
1—No. 3 Bardon & Oliver, wire feed.
1—No. 4½ Bardon & Oliver, wire feed.
1—No. 3¼-in. x 36-in. Acme Flat Turret, Bar and Chucking.
1—2¼-in. x 24-in. Jones & Lamson, Bar and Chucking.
1—2-in. Pratt & Whitney, New model, wire feed.
1—21-in. Gisholt.
1—3¼-in. x 40-in. Greenlee.
1—2¼-in. x 7-in. Gridley, 4-spindle.
1—No. 52 National Acme.
1—No. 6 Warner & Swasey.
1—No. 6A Potter & Johnston, Automatic.
1—22-in. x 8 ft. 6-in. Bullard, all power feeds, taper att.

MISCELLANEOUS

1—10-in. to 12-in. Dill Slotter, belt driven.
1—4-in. Whiton Centering Machine.
1—800-lb. Niles-Bement Steam Hammer.
3—25-lb., 50-lb., 100-lb. Little Giant Belt Hammers.
3—2-in., 4-in. and 6-in. Oster Pipe Machines.
1—2-in. Jarecki Pipe Machine.
1—No. 2 Catlin Keyseater.
1—No. 4 Catlin Keyseater.
1—No. 12 Pratt & Whitney Profiler, 2 spindles.
1—10-ft. 3/16-in. Ohl Power Squaring Shear.
Peerless Hacksaws, all sizes, new and used.

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We have in stock a large variety of new and slightly used machinery. All of it is in first-class condition.

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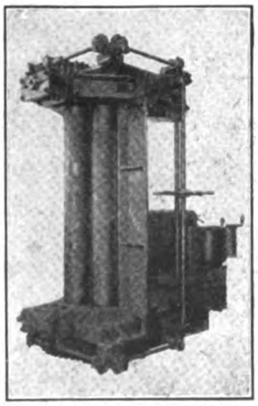

Vertical Plate Bending Roll
Cost $4000—Our Price
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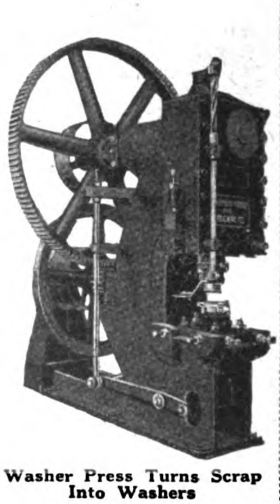
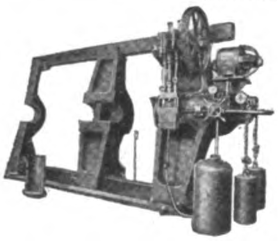
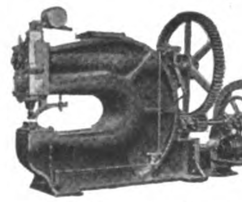


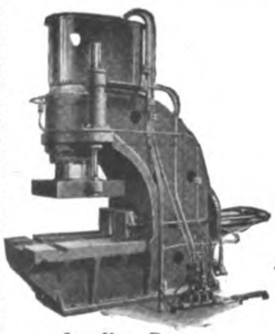
Washer Press Turns Scrap Into Washers



Wheel Press



Power Punch



Joggling Press

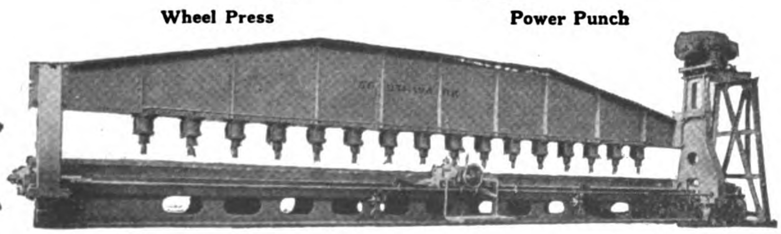


Plate Planer

Gray Rotary Cutting Shears

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Quality, Dependable MACHINERY

BORING MILLS
Horizontal and Vertical

1—No. 1 Cleveland Horizontal.
1—No. 2 Rockford; Hor.
2—NEW No. 35 Landis Horiz. boring, milling and drilling machines.
3—24-in. Bullard New Era Type Vertical Turret Lathes.
1—34-in. King Vertical Turret Lathe.
1—30-in. Rogers & Hemphill Vertical
1—44-in. Niles-Bement-Pond 2-hd., Vert.
1—44-in. Putnam, 2-hd. Vert., latest type.

RADIAL DRILLS

1—6-ft. Bickford Universal; S.P.D.
1—6-ft. Baush Plain; belt drive.
1—6-ft. Reed-Prentice Plain; S.P.D.
1—5-ft. N-B-P Semi-Universal; S.P.D.
1—4-ft. Reed-Prentice Plain; S.P.D.
1—3½-ft. Dreses S.P.D.
4—Hammond high-speed sensitive.

DRILL PRESSES

4-, 5- and 6-spindle Allen H.S.
4—NEW 36-in. Snyder upright.
10—NEW 20-in. Champion.
2—NEW Turner Vert. Drills, with tapping attachment.

LATHES

11—NEW 9 x 4, Star.
2—NEW 9 x 5, Star.
8—NEW 11 x 4, Star.
20—NEW 11 x 5, Star.
8—NEW 11 x 6, Star.
6—NEW 12 x 6, Star.
15—NEW 13 x 6, Star.
1—NEW 13 x 8, Star.
14—NEW 13 x 10, Star.
1—14 x 6 Hendey with Taper Attach.
1—14 x 6 P. & W. tool room lathe.
3—21 x 10 LeBlond S.P.D., geared hd.
1—NEW 21 x 14 South Bend Gap.
1—NEW 24 x 14 South Bend Gap.
2—24x14 Boye & Emmes D.B.G., Q.C.G.
2—NEW 24 x 10 Ryerson; cone drive.
1—24 x 12 Reed-Prentice S.P.D.
2—NEW 30 x 30 LeBlond, geared hd.; triple speed motor drive.
3—42 x 32 Bridgeford heavy duty; all geared head; 2 carriages.

PLANERS

1—48 x 48 x 12-ft.—2-head Putnam.
1—36 x 36 x 14 Cinn., 2-hd. motor drive
1—36 x 36 x 12 W. & P., 4-head.
6—26 x 26 x 8-ft.—2-head Putnam.
1—26 x 26 x 10-ft.—1-head Pond.

TURRET LATHES

20—NEW 1-in., Biggs Wire Feed.
12—3 x 36 Jones & Lamson; geared head.
1—3 x 36 J & L double spindle Flat.
4—2¼-in. x 26 Greenlee.
6—No. 1B Foster Universal.
3—No. 3-A Warner & Swasey.
7—No. 4 Foster. Plain. Head.

AUTOMATICS

10—No. 00 Brown & Sharpe auto.
3—No. 00G Brown & Sharpe auto.
4—No. 0 Brown & Sharpe auto.
2—No. 2 Brown & Sharpe forming.
2—No. 515 Natl. Acme Auto.
2—No. 52 Natl. Acme Auto.
2—No. 56 Natl. Acme Auto.
11—2¼-in. Gridley Auto.

MILLING MACHINES

1—No. 2 Rockford Univ., S.P.D.
1—No. 3 Cincinnati Vertical.
1—No. 1 Kempsmith Plain.
1—No. 3 Brown & Sharpe Plain, S.P.D.
1—No. 3-B Milwaukee Plain.
1—No. 5 Cincinnati Plain, Rect. Arm.
1—No. 3 Garvin Duplex.
1—NEW No. 3-A Becker Ver.
5—No. 5-C Becker Ver.
1—Model C Becker Ver.
1—No. 2 Brown & Sharpe Ver.
1—No. 3 Cincinnati Ver.
1—No. 4 LeBlond plain.
10—2 in. and 4 in. P & W Spline.
Also 250 Hand and Mfg. Millers.
No. 6 Whitney, No. 12 Pratt & Whitney
1—No. 4 LeBlond plain.
1—No. 33 Kempsmith heavy duty.

MISCELLANEOUS

1—2-in. National sgle.-hd. Bolt Threader.
2—1-in. Acme, Double Bolt Threaders.
1—54-in. (Eberhardt Bros.) Gear Cutter.
1—24-in. S. & S. Gear Hobber.
1—1100-lb. Erie Steam Hammer.
1—½-in. Cap. 48-in. throat QUICK-WORK Rotary Shear.
1—No. 3 L. & A. 48-in. throat Shear.
1—No. 4 Lapointe Broaching Machine.
3—NEW 15-in. Newton Slotters.
3—No. 6 Fellows gear shapers.
2—No. 3 26-in. Cincinnati Gear Cutters.
2—Norton crank balancing machines.

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SECOND-HAND MACHINERY

Located at Our Various Factories and Stores

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9-in. x 18-in. Taper, Porter-Cable.
14-in. and 16-in. x 8-ft. Whitcomb, Q.C.
17-in. x 6-ft. and 8-ft. LeBlond Geared Heads.
20-in. x 10-ft. LeBlond Q.C.
24-in. x 24-ft. Niles.
26-in. x 10-ft. Pond, 220-v., D.C. Motor.
28-in. x 12-ft. Pond.
28-in. x 18-ft. Niles Taper.
32-in. x 17-ft. Pond, T.G.
36-in. x 12-ft. Pond, T.G., 220-v., D.C. Motor.
36-in. x 17-ft. Pond Taper, 220-v., D.C. Motor.
36-in. x 20-ft Pond 220-v., D.C. Motor.
36-in. x 28-ft. Bement, T.G.
42-in. x 17-ft. Pond, T.G., 220-v., D.C. Motor.
42-in. x 20-ft. Niles, T.G.
48-in. x 24-ft. Pond Geared Head, 220-v., D.C. Motor.
48-in. x 30-ft. Niles, T.G.
50-in. x 17-ft. Miles (Old Style).
54-in. x 28-ft. American, T.G., 220-v., D.C. Motor.
63-in. x 40-ft. Bement, T.G.

PLANERS AND SHAPERS

20-in. G. & E. Shaper.
20-in. Stockbridge Shaper.
20-in. x 20-in. x 6-ft. Bement.
24-in. x 24-in. x 6-ft. Powell.
24-in. x 24-in. x 6-ft., 8-ft. and 10-ft. Whitcomb B.
26-in. x 26-in. x 6-ft. Gray.
30-in. x 30-in. x 6-ft and 10-ft. Pond, 2 Heads.
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36-in. x 36-in. x 10-ft. to 16-ft. Niles.
36-in. x 36-in. x 12-ft. to 16-ft. Pond, Reversing Motors.
36-in. x 36-in. x 24-ft. Bement.
42-in. x 42-in. x 14-ft. Bement.
42-in. x 42-in. x 26-ft. Pond, Reversing Motor.
48-in. x 48-in. x 16-ft. Pond, Reversing Motor.
48-in. x 48-in. x 20-ft. Bement, Belt.
54-in. x 36-in. x 10-ft. Bement, Belt.
50-in. x 36-in. x 22-ft. Pond, Reversing Motor.
54-in. x 54-in. x 12- to 22-ft. Pond, Rev. motors.
60 in. x 60-in. x 14 ft. to 24 ft. Niles, Belt.
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72-in. x 60-in. x 14-ft. Bement, Reversing Motor.
72-in. x 72-in. x 20-ft. Ridgway, Forge, Reversing Motor.
76-in. x 76-in. x 26-ft. Pond, Reversing Motor.
10-ft. x 10-ft. x 36-ft. Betts, 220-volt, D.C. Motor through belts.

MILLERS AND GEAR CUTTERS

No. 2-A B & S Universal.
No. 2-B Single Pulley Plain, B. & S.
No. 4 Plain, Cone Pulley, LeBlond.
No. 4 Plain, Cone Pulley, B. & S.
No. 5 Plain, Cone Pulley, B & S.
No. 5 Vertical, Cone Pulley, B. & S.
6 x 48 to 132 in. P. & W., Old Style Thread Millers.
14-in. No. 5-A Lees-Bradner Gear Generator.
15-in. Gleason Bevel Gear Generator.
16-in. Cincinnati Gear Hobber (New).
36-in. to 60-in. B & S Spur Gear Cutters.
No. 3—36-in. Newark, 220-volt, D.C. Motor.
No. 4—48-in. Newark, 220-volt, D.C. Motor.
No. 55—36-in. Newark Heavy Pinion, 220-volt, D.C. Motor.

DRILLING MACHINES

1-Spindle Pierle BB.
32-in. Aurora Tap. Att.
40-in. Aurora Tap. Att.
4-ft. Bickford Speed Box Radial.
5-ft. Niles Full Universal Speed Box.
5-ft. Ridgway, 20-volt, D.C. Motor.
6-ft. Pond, 220-v., D.C. Motor.
6-ft. Niles, Full Universal, Speed Box.
12-Spindle No. 13 P & W Multiple.

BORING MACHINES

36-in.—44-in. Niles Side Head Mill.
51-in. Niles Mill, with Turret Head.
60-in. Bement B & T Mill.
72-in. Ridgway, 220-volt, D.C. Motor.
10-ft. Niles, 220-volt, D.C. Motor.
10-ft.-16-ft. Niles, 220-volt, D.C. Motor.
2½ and 3-in. Lucas, Horizontal.
4½, 5 and 6½-in. Niles Floor Borers.
2½ to 4⅝-in. Horizontal Boring and Drilling Machines.

EVERY ONE A BARGAIN

MILLERS AND SHAPERS

1—No. 2B Milwaukee Universal Miller.
1—No. 2 Van Norman Duplex Miller.
1—No. 1½ Cincinnati Universal Miller.
No. 5 Brainard 60-in. table mtr. dr. Miller.
2—Becker-Lincoln Type Millers, $125 each.
2—16-in. Gould & Eberhardt B.G. Shaper.
2—20-in. Smith & Mills B.G. Shaper.

LATHES

2—Hendey, 16 x 8, late type.
2—Monarch 14 x 6 Lathes, taper attachment, latest type.
2—14-in. x 6-ft. Walcott Lathes, new, Q.C.G., D.B.G.
2—16 in. American Fox Lathes.
6—LeBlond 19 x 8, Q.C.G., D.B.G. Like new.

DRILLS AND GRINDERS

6—New Excelsior, 14-in. sensitive.
9—Buffalo 20-in. B.G. drill, new.
5—No. 11 B. & S. plain grinders, late type.

PRESSES

14—V & O 101 Presses, 5-in. stroke.
9—V & O 102, 5-in. stroke, dial feed.
3—V & O 103, 6-in. stroke, dial feed.
6—No. 1½ V & O Presses.
8—No. 2 V & O Presses.
2—No. 6 Leffler Double Action Presses.
1—No. 8 Leffler Inclinable Press.

MISCELLANEOUS

3—Model G. Cleveland Automat. ⅝-in., like new.
2—No. 3 Foster F. B. G. Turret Lathes, like new.
4—No. 5 Foster F. B. G. Turret Lathes, like new.
1—No. 105½ Bliss Metal Slitter.
2—No. 1 B. & S. Semi-Auto. Screw Machines.
1—No. 1 Gray Sheet Metal Cutter.
1—1⅝-in. Pratt & Whitney Screw Machine, lot of equipment.

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12—SELLEW 16 in. with univ. tables, NEW.
22—DAVIS 14-16-20-24 in. B.G., both c/s and S.P.D., all NEW.
10—ROCKFORD Shapers—all sizes—all NEW.
4—QUEEN CITY 16-20-24 in. B.G., all NEW.
3—16-18-24-in. GOULD & EBERHARDT, b.g.
2—16 and 20 in. MILWAUKEE b.g., like new.
2—SLOTTERS, 6 in. Newton, complete, NEW.
3—SLOTTERS, 12 in. Betts, with rotaries.
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1—No. 2½ ROCKFORD Univ. heavy, NEW.
1—No. 3 CINCINNATI Univ. heavy duty.
2—BRIGGS type "B," 42-in. Production.
3—P. & W. 12-in. heavy AUTO., all NEW.
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1—No. 1 BROWN & SHARPE Vertical, NEW.
15—Lincoln type, and others, all sizes.

Lathes, Screw Machines, etc.

2—HENDEY 14 in. x 6 ft., tapered, like new.
5—PUTNAM 26 in. x 25 ft., q.c.f., like new.
1—30 in. x 11 ft. AMERICAN, Q.C. Geared.
10—26 in. x 9 ft. BRIDEFORD q.c.g., like new.
1—16 in. x 10 ft. WHIT.-BLAISDELL metric.
40—Other good lathes, all sizes and makes.
1—No. 2½ V. & O. Inclin., 99% new.
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5—No. 2 FOSTER HAND SCREW MACHINES.
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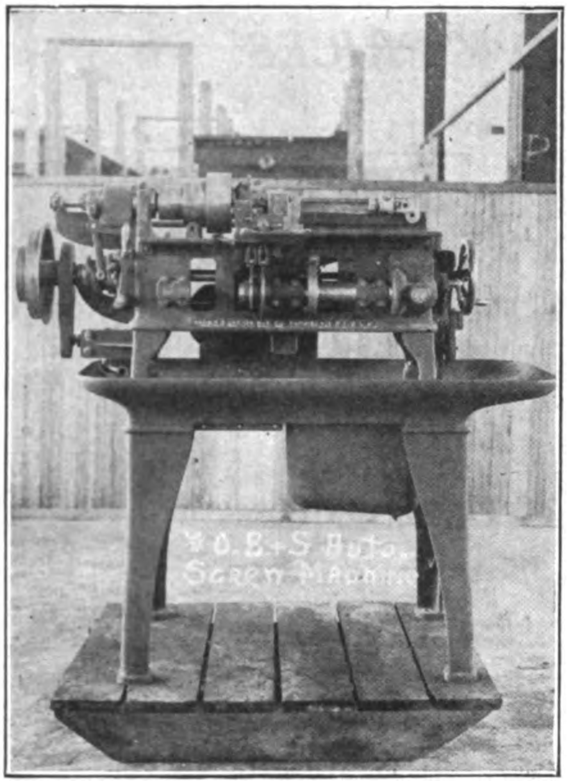

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***We bought them right—
Overhauled them right—
Will sell them right—***

22 No. 0 Brown and Sharpe Automatic Cutting-off Machines

Capacity ..... ½" x 12"
Greatest length feed by one movement ..... 3"
Movement of tool slide 2"
Drive—3 step for 2¼" belt.
Net weight—approximately 1275 pounds.

Price f.o.b. Bridgeport

$250.00

15 No. 2 Brown and Sharpe Automatic Cutting-off Machines

Capacity ..... ⅞" x 16"
Greatest length feed by one movement ..... 4"
Movement of tool slide 3"
Drive—3 step cone for 2¾" belt.
Net weight—approximately 1800 pounds.

Price f.o.b. Bridgeport

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This is an actual photograph of these machines. We have thoroughly overhauled them and guarantee them to be in first-class operating condition with countershafts. Do that job automatically! At these prices the machines will surely pay for themselves in a short time. Send us yor order with one-third deposit or better still come and see them.

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ENGINE LATHES TRIPLE GEARED SCREW CUTTING

96 x 37 Fifield, 27 ft. centers.
68 x 40 Pond, 30 ft. centers.
60 x 40 Fifield, 30 ft. centers, with 2 carriages on bed, with compound rests, hollow spindle. (2 machines.) Nearly new.
36 x 32 American Tool Works, 25 ft. centers, with 2 carriages on bed, with compound rests, have power angular feed, quick change. Nearly new. (3 machines.)
36 x 32 LeBlond, 25 ft. centers with carriages on bed, compound rests, taper attachment, quick change. Nearly new. (2 machines.)

ENGINE LATHES (NOT SCREW CUTTING) PLAIN TURNING

36 x 27 Niles-Bement-Pond, heavy duty, all geared head, 21 ft. centers.
36 x 33 Niles-Bement-Pond, heavy duty, all geared head, 27 ft. centers.
48-in. Niles Double Head Car Wheel Turning Lathe, with 2 carriages.

TURRET LATHES

Gisholt 24-in. swing with 4-way turret tool post on carriage, tilted hex. turret on bed with power rapid traverse—taper attachment, triple geared pan bed pump— 6¼ in. hole in spindle (10 machines) latest model.
Pond 28-in. swing same—4½ in. hole in spindle.

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Hanna compression Riveter 15 in. Reach 10 in. capacity 1¼ in.
1000 Pneumatic chipping Rivet Hammers and Air Drills

HAMMER-STEAM-BELT-BOARD

1100 lb. Steam Single Frame Open Type.
800 lb. Erie Single Frame Steam Hammer.

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Ingersoll 24-in. x 24-in. x 12-ft. Table Horiz. Slab Milling Machines, with INCLINED ADJUSTABLE RAIL—(Brand New; 6 machines). Weight about 25,000 lb.
BECKER No. 5-C, Latest Improved Model, Single Pulley Drive (All Geared Speeds). Table 56 x 14 in. (Automatic Feeds 54 in. x 16 in. x 14 in.) 2 machines.

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New Doty Plate Bending Roll, 6 ft. for ¾ in. plate Housing Suspension Device—Power Raise and Lower, arranged for Motor Drive. Weight about 20,000 lbs.
Ajax No. 7 Bulldozer 16 in. x 60 in. Weight 35,000 lbs.
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Roll 36 in. for corrugating Sheets. Weight about 4500 lbs.
Lewis 16 in. Bar Rolling Mill.
72 in. Plate Rolling Mill.
1 Allen Jaw Air Riveter, 66 in. rach, 13½ in. gap, dia. of air cylinder 11½ in., capacity 1 in. rivets. Cast Steel Frame. Can be used in either Vert. or Horiz. Position; 250-hp. Mtrs.

ELECTRIC MOTORS

6—Westinghouse Induction Alternating, Type CCL, 250-hp. Motors, 440 v., 3 ph., 60 cy., speed 514 r.p.m.

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on T-W Universal Geared scroll 3 jaw (2 sets of jaws)

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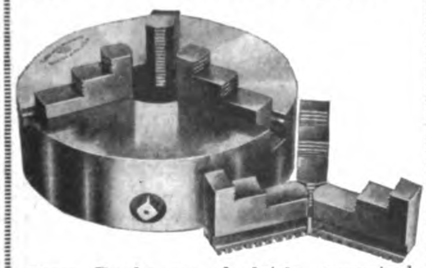

These Chucks are absolutely guaranteed against any defect in material, construction or accuracy.

BETTER THAN THE BEST

In all sizes:	*List*
4 inches	$22.00
5 inches	24.00
6 inches	28.00
7½ inches	32.00
9 inches	38.00
10½ inches	44.00
12 inches	52.00
15 inches	70.00

FIFTY (50) PER CENT. OFF LIST

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Gear Cutting and Hobbing Machines

in excellent condition

Machines listed below have been rebuilt and put into excellent operating condition.

2—36 in. x 10 in. G. & E. Vertical Type Gear Cutting Machines, No. 36-S, for spur gears only.
3—48 in. x 10 in. G. & E. New Type Gear Cutting Machines for spur gears only.
1—24 in. x 12 in. G. & E. Automatic Gear Hobbing Machine.
1—No. 2 Reinecker Universal Gear Hobbing Machine.

The following machines have been in service a very short time and are almost as good as new.

1—No. 2 Barber-Colman Hobber.
1—No. 5 Lees-Bradner Automatic Hobbing Machine.

All these machines are being offered at exceptionally low prices.

GOULD & EBERHARDT

NEW

CINCINNATI OPENSIDE PLANER

48 in. x 48 in. x 12 ft.
2 Rail Heads.
1 Side Head.
Overhead Countershaft.
Supplementary Table.

Price $7500

Machine on its original skid. All bright parts as originally slushed.

An exceptional buy, considerably below manufacturer's present price.

The New Britain Machine Co.
New Britain, Conn.

POWER PRESSES

All Makes and Types
New and Rebuilt

LARGE SELECTION
OF
INCLINABLE
FLYWHEEL
STRAIGHT SIDE
AND GEARED PRESSES

At Prices that Represent a Large Saving

Priced at Rock Bottom Before Removal

1—76½ BLISS TRIMMING PRESS
1—75½ BLISS TRIMMING PRESS
with Side Shear
Arranged for Motor Drive

Joseph Hyman & Sons
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Philadelphia, Pa.
Write Today for Our Price List.

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Air Compressors, Chicago Pneu., 9 x 8 and 12 x 10
Die Heads, Namco, ½ to 2 in., self-opening.
Drills, Henry & Wright, 1 and 2 spindle, high speed
Drills, 20-in., new, special price $111.50 each.
Grinder, 10 x 24 in. Norton, plain.
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Lathe, Barnes, 9 in., comp. rest, hollow spindle
Lathe, LeBlond, 13 in. x 5 ft., collet attachment
Miller, Bilton, No. 25, plain
Miller, Briggs, Type "A"
Motors, G. E., ½ to 50 hp., 3-phase.
Oil Groover, Garvin, new
Oil Separator, Springfield
Pipe Machines, 2, 4, 6 and 12 in.
Planer, Pond, 44 x 44 in. x 12 ft. 4 hd.
Plate Grinders, Yates, 36 and 66 in.
Radial, Morris, 3 ft., plain, cone drive
Shaper, Steptoe, 16 in.
Torches, welding and cutting
Turret Lathe, Tilted, 1½ in., power feed
Universal Grinder, W. & P., 10 x 30 in.

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Columbus, Ohio
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Stark & Ames bench lathes.
12 and 14 in. Hendey tool room lathes.
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Auto. Machine Co.'s threading lathes.
All sizes and makes of B.B. drills.
No. 3 Becker vertical miller.
Screw machines, Auto. and Hand, large stock.
Power presses, new and used, large stock.
Grinders, of all kinds and large stock of new and used.
This is only a very few of our large stock of new and used machinery which we should be pleased to have you inspect. Kindly send your requirements to us so that we can figure.

Send for Complete List.

IDEAL MACHINERY COMPANY
Plainville, Conn.

6 BRAND NEW Engine Lathes

—CLEVELAND—

16 in. x 6 ft. cabinet legs with regular factory equipment. Send for photo.

$375.00 Each

MACHINERY DEALERS, Inc.
New Haven, Conn.

Machinery For Sale

LOW PRICES

1—4 spindle cylinder borer, Foote Burt make.

2—6 spindle cylinder borer, Foote Burt make.

1—4 spindle Ingersoll Cylinder miller.

1—No. 59 Toledo Press.

1—No. 94-H Toledo Press.

Full line of lathes, shapers, milling machines, automatic screw machines, Potter Johnson and J. & L. machines, hand screw machines, drilling machines, sensitive and power, sheet metal machinery, all kinds, blacksmith and forge equipment, wood working machinery, belting, pulleys, shafting, drills, taps, dies, reamers, cutters, all kinds.

Send your inquiries to

METZ FACTORY, Waltham, Mass.

R. E. Threfall and W. F. Coye

High Speed Steel—*Machine—Tool—Special*

30 to 50 Per Cent Under the Market

	Tons
Lot No. 290—**Machine Steel** (Round, square, flat)	23
Lot No. 291—**Cold Roller Shafts**	7
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Lot No. 293—**Special Steels** (Oil Hardened, Nonshrinkable, Tool), Vasco, Ketos, etc (Hexagonal, Octagonal, Round)	3
Lot No. 294—**Tool Steel**—Midvale, Columbia, Bethlehem, Champion, S. A. E., Atlas, Monarch, Standard, Holcomb, Bobson, etc. (Round, square, flat)	60
Lot No. 295—**Tool Steel**—Jessup, Sanderson, Pompton, Firth Sterling, Red Cut Superior—(Round and square)	7
Lot No. 296—**Tool Steel**—Red Cut Superior, Blue Chip, H. S. Firth Sterling, Rex A. A. (Round and square)	12
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Phones: Franklin 3003-3004

ONE NO. 0 GIDDING & LEWIS HORIZONTAL BORING DRILLING AND MILLING MACHINE—

New—Set Up But Never Used

Federal Equipment & Supply Co.
110 W. 40th Street, New York.

PLANERS

42-in. x 42-in. x 12-ft. Powell Planer with three heads, in excellent condition.
48-in. x 48-in. x 12-ft. Pond Planer with four heads, in excellent condition.
Powell Planer, 60 in. between housings, 20-ft. bed, parallel drive, two heads.

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No. 4 Cincinnati high-speed, all geared head, single pulley drive, plain milling machine with vertical attachment, 90% new.
No. 3H LeBlond plain milling machine with vertical attachment, friction double back geared head, 90% new.
No. 3 Kempsmith plain milling machine with pump, 90% new.

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137 Oliver Street, Boston, Mass.

Botwinik Brothers Specials

MILLING MACHINES

Brown & Sharpe No. 1 Universal, cone drive.
Cincinnati No. 1 Universal, cone drive.
Brown & Sharpe No. 2A Universal, single pulley.
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Hendey No. 2A Universal, single pulley.
Cincinnati No. 3 Universal, cone drive.
Brown & Sharpe No. 3A Heavy Universal, single pulley.
Rockford No. 1½ Plain, Index Heads, etc.
Browne & Sharpe No. 2 Plain, Index Heads, etc.
Brown &Sharpe No. 2 Plain, Index Heads, etc.
Fox No. 3½ Plain, complete.
Garvin No. 4 Plain, Index Heads, etc.
Brown & Sharpe No. 5 Plain, complete.
Kempsmith No. 6 Plain, complete.
Brown & Sharpe No. 12 Mfg. Type.
Garvin No. 13 Plain, complete.
Becker--Brainard No. 20 Plain, complete.
Van Norman No. 2 Duplex, Dividing Heads, etc.
Becker No. 3 Vertical, complete.

BOTWINIK BROTHERS
21 Sylvan Ave., New Haven, Conn.
28-12 Drouve St. Bridgeport, Conn.

36 in. BULLARD

VERTICAL TURRET LATHE

99 per cent new. Money-saving price.

MILES MACHINERY CO., Saginaw, Mich.

Gisholt Turret Lathes

In very good condition. 14 in all. Take your choice. We need the room.
Special low price.

WAYNE MACHINERY CO.
Ft. Wayne, Ind.

SPECIAL OFFERINGS

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No. 1M Potter & Johnson Continuous Automatic.
No. 5C Becker Vertical, Rotary.
No. 6 62 in. Becker Vertical.
No. ½ Van Norman Duplex.
No. 1 Brown & Sharpe Plain.
No. 1 Brown & Sharpe Universal.
No. 2 Leblond Universal.

DRILLS
No. 1 Langelier High Speed Ball Bearing Bench.
20 in. Prentice Sliding Head Open Belt.
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24 in. Cincinnati Sliding Head, Tapping Attachment.
Henry & Wright Sensitive Radial.
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3 and 4-spindle Reed-Prentice BB Sensitive.

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16 in. Flather, Gear Box.
16 in. Sellew Tool Room.
24 in. Sellew Tool Room.
24 in. Potter & Johnston Universal.
17 x 17 x 4 Whitcomb Planer.
22 x 22 x 5 Whitcomb Planer.
24 x 24 x 6 Gray Planer.
36 x 36 x 13 Betts Planer, 4 heads.
48 x 48 x 16 Patch Planer, 4 heads.

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40 lbs. Bradley Cushioned Helve.
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300 lbs. Beaudry Champion.

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5 x 8 McWilliams.
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11 x 10 Standard Machinery Co's.

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No. 5 Bliss Stiles & Parker Press.
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Kidder Tilting Top Saw Tables.
Clement Double Arbor Saw Table.
No. 52 Dover Vertical and Horizontal Boring Machine.
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Beach Jig Saw.
24 in. White Double Belted Single Surface Planer.
Type D-1 Syracuse Motor Driven Disc Sander ½ hp. 220 VDC motor.

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GUARANTEED
Machine Tool Bargains

Partial List

No. 60 Heald Cylinder Grinders.
1¼-in. Gridley Multiple Spindle Automatics.
44-in. Putnam High Duty Vertical Boring Mill, Turret Head.
60-in. Bullard Vertical Boring Mill.
3-in. Betts Horizontal Adjustable Knee Type Boring Mill.
No. 14 Pratt & Whitney Multiple Spindle Drill. 12 Spindles, 1¼-in. Drills.
12-in. x 72-in. Norton Cylindrical Grinder.
20-in. x 96-in. Landis Cylindrical Grinder.
24-in. Steinle Side Carriage Turret Lathes.
42-in. x 20-ft. Heavy Duty Triple Geared Engine Lathe, 12 ft. 6 in. between centers.
24-in. x 24-in. x 5-ft. Whitcomb Tool Room Planer.
No. 13 Brown & Sharpe Spur and Bevel Gear Cutter. Gears 18 in. x 4 in.
22-in. x 10-ft. Cincinnati Traveling Head Shaper.
No. 77½ Bliss Straight Side Tie Rod Frame Press.
No. 67 Adriance Straight Side Tie Rod Geared Press, weight 15000 lbs.
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8-in. Newton Slotter, Rotary Table.
24-in. Bullard Vertical Turret Lathe.

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Satisfaction Guaranteed or Money Refunded

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Established 1900.

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Machines purchased direct from makers and held in high grade New York warehouses. Every tool absolutely brand new and in first class condition. Prices are below the market.

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17 BATTERY PLACE
NEW YORK

R S S NEW YORK

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Steam Engine, 125 I.H.P. Vilter-Corliss.
Oil Engine, 80-hp. Venn-Sev.
Sandblast Machine, 1000-lb. Mott.
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2½ to 30-hp. A.C. and D.C. Motors, various types.
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24-in. Sellers Slotter.
26-in. Niles Gd. Slotter.
1½-ton Available Motor Truck.
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Iron Safe, 43 in. wide, 31 in. deep, 6 ft. high.
9-hp. Water Motor Gas Engine.
Geared Fdry. Ladels, Tumbling Barrels, Belting, Chain Hoists, Floor Cranes, Shafting, Floor Trucks, Office Furniture and Fixtures.

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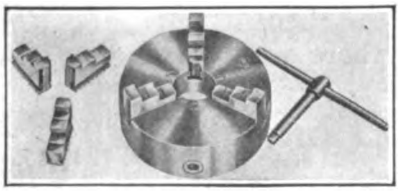
Dept. "C-5"

NEW CHUCKS
Universal Geared Scroll
Made by Gisholt Machine Co.
50% off List Price



Improved Standard Pattern, particularly high class and heavy construction. Chuck bodies are of close grained Cast Iron.

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7½ in.	$16.00
9 in.	19.00
10½ in.	22.00
12 in.	26.00

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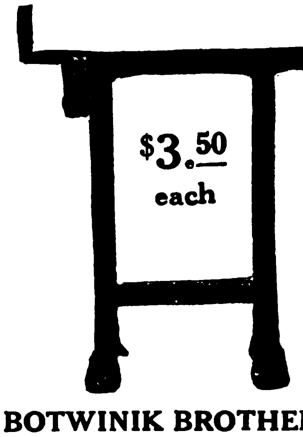
1000 New Britain Pressed Steel Bench Legs—Practically New



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MILLING MACHINES
Plain and Universal

NEW
3—No. 1½ Rockford Univ., cone type, 25x7½x18.
2—No. 2½ Rockford Univ., cone type, 34x9x18.
1—No. 2½ Rockford Univ. high power geared, single, pulley drive; cap. 34 x 9 x 18.
1—No. 1½ American Univ., cone type, 25x9x18.
1—No. 1½ American Plain, cone type, 25x9x19.
1—No. 0 Bickett Vert. Miller and Profiler.

USED
1—No. 1½ American Plain, cone type.
1—No. 2 Becker Plain; arranged motor drive.
6—No. 32 Kempsmith, Lincoln type, 36 x 12.
1—Ingersoll Slab, 20 x 20 x 8 ft.
1—No. 1 Newton Keyseat Miller; arranged M. D.
1—No. 2 Newton Keyseat Miller, arranged M. D.

A FEW MISCELLANEOUS SELECTIONS
3—16 in. x 8 ft. Sidney Lathes; Q. C., D. B. G.
1—50 in. Sellers Car Wheel Borer.
1—52 in. Bertsch Multiple Punch.
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12—Gisholts 21 in and 24 in. Turret Lathes.
14—Screw Machines; ⅛ to 3¼ in. cap.
4—Radial Drills; 3½, 4 and 5 ft. plain and univ.
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1—No. 20 Bliss Inclinable Press.
1—No. 20 Lea Simplex Metal Saw.

We have over 1,000 machines in stock. Send us your inquiries. Our Guarantee: Money back if not satisfied.

Wayne Machinery Co., Ft. Wayne, Ind.

Good As New and Priced Reasonable

1—Brown & Sharpe No. 2 Universal Cylindrical Grinder with raising blocks.
2—Rivett No. 103 Internal Grinders.
6—No. 52 National Acme 4 spindle Automatics.
6—3¼-in. Gridley Single Spindle Automatics.
2—2-in. Cleveland Model A Automatics.
1—Wymouth Wood Turning Lathe, No. 4.

Other desirable standard machines.

Morris Machinery Co.
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BLANCHARD GRINDER

1—24 in. Vertical Blanchard Surface Grinder, direct drive, with 20 hp. G. E. motor, 440 v., 60 cy., 3 ph., 870 r.p.m., and G. E. motor, 2 hp., 440 v., 60 cy., 3 ph. GOOD CONDITION. We offer subject to prior sale.

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No. 3¾-A
BLISS TOGGLE PRESS

Will draw and lift out 9½-in. Largest blank 25 in. Diameter of drawing punch 16 in.

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Bought and Sold

I am specializing in Used Spot and Butt Electric Welding Machines. Tell me your needs and I may have a Used Machine that is good as new that I can furnish you at a big saving. Or if you have any Electric Welding Machines that you have no further use for, I will buy them.

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25 POTTER & JOHNSTON

Automatic Chucking Machines
No. 6-A Geared Head

$350.00 Each

MACHINERY DEALERS, INC.
New Haven, Conn.

BRAND NEW
LATHE

"New Haven" Heavy Pattern New Engine Lathe (double back-geared). 24-in. swing, 24-ft. bed. 18 ft. 4 in. between centers; belt driven. Apply to

KONIG BROS. & CO.
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WANTED

NEW NO. 4 VAN NORMAN
INTERNAL GRINDER

With swivel table, full equipment.
Price $800.

NEW YORK MACHINERY EXCHANGE
50 Church Street, New York.

Wanted to Buy
Toggle Drawing Press

With a stroke on drawing punch of 26 in.

Give full information

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GUARANTEED NEW AT USED MACHINE PRICES

LATHES
5—14-in. x 6-ft. Whitcomb.
2—14-in. x 6-ft. Whitcomb, M.D.
5—16-in. x 8-ft. and 6-ft. Whitcomb.
4—18-in. x 6-ft.-8-ft. Whitcomb, G.H.
3—18-in. x 8-ft.-10-ft. Whitcomb, G.H.
5—20-in. x 8-ft.-10-ft.-12-ft. Whitcomb.
1—26-in. x 14-ft. Whitcomb, H.D.
Taper and other attachments can be applied to all.

MILLERS (Vertical)
2—2-H Becker.
7—3-H Becker.
4—AB-2 Becker.
1—Model "B" Becker and 1 Model SB.
8—Model "C" Beckers.
3—Model C-1 Beckers.
2—Model C-2 Beckers.
3—Model ACS Beckers.
All with or without ROTARY att. Partial list.

McCOY BRANDT MACHINERY CO.
210-14 Penn Ave., Pittsburgh, Pa.

LARGE STOCK OF NEW
H. S. MILLING CUTTERS, SLITTING & SCREW SLOTTING SAWS, ENDMILLS, COUNTERBORES, COLLETS, REAMERS.

Half Price or less. Send for Complete List.

PAUL FROILAND
Leyfred Terrace, Springfield, Mass.

WANTED
GUN DRILLING MACHINE

With capacity for ⅞-in. diameter hole, 44 in. long. Pratt & Whitney. No. 1½ preferred.

WRIGHT AERONAUTICAL CORP.,
Paterson, N. J.

New No. 2 Ohio Plain Miller, New.
16-in. x 9-ft. Lehmann QCG Lathe.
16-in. x 8-ft. Oliver QCG Lathe.
18-in. Prentice Turret Lathe.
24-in. x 24-in. x 8-ft. Putnam Planer, 2 heads.
1-in. Pratt & Whitney Screw Machine.
2—No. 5 Hendey Lincoln Millers.
No. 13 Brown & Sharpe Universal Grinder.

Harry F. Allen, 30 Church St., New York

WANTED TO BUY
USED
PIPE THREADING MACHINE

1—6-in. also 1—12-in. capacity, good condition only.

KINGHAN MACHINE SHOP
Enid, Okla.

FOR SALE
Bevel Gear Planer

Gleason Generating Type, 11 in. Late type, all complete, fine condition, immediate delivery at one-third present cost.

G. L. SIMPSON
P. O. Box 1125, Pittsburgh, Pa.

10 in. x 36 in.
NORTON GRINDER

Plain Grinder with countershaft, slightly used. Offered at a big saving.

MILES MACHINERY CO., Saginaw, Mich.

GRAND RAPIDS SPECIALS
1—9-in. Porter Cable Manufacturing Lathe.
1—9-in. Sunstrand Mfg. Lathe; 1—16-in. Chard Prod. Lathe; 1—16x7 Oliver QCG Lathe.
1—24x10 Schumacher-Boye Std. Lathe.
1—6-spindle Rockford 14-in. Gang Drill.
1—No. 2 Rockford High Power Miller.
1—No. 2 H. Becker Vertical Miller.
1—30x30x8 Pond Planer.
Ask for complete list.

McMULLEN MACHINERY CO.
Grand Rapids, Mich.

Your Shop's Most Interesting Corner

It's probably an eye-sore to you—that mass of dust covered and cob-webbed equipment in the corner.

But to the man who can use the machinery you have stored there, it may be the most interesting corner of your shop.

If the tools are in good condition, though dusty, there is a market for them. Tell prospective buyers everywehere what you have to sell.

You can reach the largest number at small cost through an advertisement in the

Searchlight Section of *American Machinist*

SEARCHLIGHT SECTION

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Offered for Re-sale

Space for these advertisements is sold by the advertising inch—30 inches to a page. The price per inch is based on total space used—multiply ad space by number of insertions.

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RATES FOR LARGER SPACES, OR SPACE ON A YEARLY BASIS, FURNISHED ON REQUEST.

Am. Mach.

POSITIONS VACANT

Delaware

ESTIMATOR for customs machine shop and foundry; location Wilmington, Del.; must have had several years' experience in machine shop and foundry estimating and have the ability to direct the preparation of estimates for this kind of work. Reply must state fully past experience, present employment and salary expected. P-35, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

Illinois

MECHANICAL draftsman wanted, with experience in the design of automatic machines and fixtures; technical graduate preferred, but consideration will also be given to intelligent experienced man without technical training; location 25 miles from St. Louis, Mo. State age, education, experience and salary expected. Address P-44, Am. Mach., Old Colony Bldg., Chicago, Ill.

STEEL engraver, who can also do tool work. Please state age, qualifications and wages expected. Courteous consideration will be given your application by growing company in Middle West. Address P-33, Am. Mach., Old Colony Bldg., Chicago, Ill.

POSITIONS VACANT

Pennsylvania

HIGH grade machinist, a thorough mechanic, capable of operating modern machine tools in an efficient and up-to-date manner and capable of developing and applying jigs and fixtures in the production of power transmitting machinery. P-50, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

MACHINIST, familiar with modern methods of machine tool assembly, to act as working sub-foreman. P-51, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

WANTED, a working foreman, for a small machine shop equipped for contract work and jobbing; a capable mechanic of good character to come up with the business. Write us frankly about yourself and your expectations. Morehouse Machine Co., York, Pa.

Vermont

DRAFTSMAN on textile machinery wanted; permanent situation; one who has worked on cloth finishing machinery preferred. Give age, experience and terms. P-34, Am. Mach., 10th Ave. at 36th St., New York City.

POSITIONS VACANT

Wisconsin

ADVERTISING man on machine tools. State age, schooling experience and salary expected. P-48, Am. Mach., Old Colony Bldg., Chicago, Ill.

SALES correspondent, with experience on machine tools. State age, experience and salary expected. P-49, Am. Mach., Old Colony Bldg., Chicago, Ill.

EMPLOYMENT AGENCIES

GENERAL ENGINEERING AGENCY, Pittsburgh. Serving employers everywhere, overnight proposals, gratis, require Works Managers, Superintendents, Chief Draftsmen, Designers, Plant Engineers, Master Mechanics, Tool Draftsmen, Salesmen, Foundry, Forge, Machine Shops, General Office.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000 upward; executive, technical, administrative, engineering, manufacturing, professional, managing, financial, etc., all lines. If you are qualified and receptive to tentative offers for a new connection, you are invited to communicate in strict confidence with the undersigned, who will conduct preliminary negotiations for such positions. A method is provided through which you may receive overtures in confidence without jeopardizing present connections and in a manner conforming strictly to professional ethics. Send name and address only. Preliminary particulars will be sent without obligating or compromising you in any way. R. W. Bixby, Inc., 407 Lockwood Bldg., Buffalo,

Assistant to President

The president of a company manufacturing light office appliances is in need of an assistant skilled as an engineer and designer along similar lines, and possessing proven executive ability as well.

He must have tact and be able to adapt himself to local conditions. He must be at least 35 and not more than 45. He must be able to show a clean record and that he has done things worth while. Give full particulars in first letter, which will be kept in strict confidence and returned if desired.

P-40, American Machinist, 1570 Old Colony Bldg., Chicago, Ill.

POSITIONS WANTED

New Jersey

DRAFTSMAN, designer, European mechanical engineer; age twenty-six; five years high technical schools; six years' experience on tool machines, toolmaking, automobile and electric motors; knowledge of forge, foundry, patternmaking, processes; able to save workmanship and material; available immediately; salary expected $2,000. PW-46, Am. Mach., 10th Ave. at 36th St., New York City.

We Want a Mechanical Engineer Who Can Do This:

1st: Design high-grade office and printing machinery.
2nd: Follow latest machine shop, foundry and pattern shop practice.
3rd: Be original, tactful and have executive ability.
4th: Be big and broad enough to work in perfect harmony with other men.
5th: Show that your experience and ability justifies the salary you ask.
6th: Show several years of experience in same or similar line of work.

Give full particulars in first letter which will be kept confidential.

P-39, American Machinist, 1570 Old Colony Bldg., Chicago, Ill.

WANTED

Inspector and Foreman

Experienced Inspector familiar with heavy work. Also Foreman to take charge of heavy tools. Apply

THE TOLEDO MACHINE & TOOL CO.
Dorr St. & N. Y. C. Railroad, Toledo, Ohio.

EXECUTIVES

Qualified men—Technical, Commercial and Manufacturing—seeking new positions find our effective and confidential service extremely satisfactory. Our Mr. H. H. Harrison can negotiate a suitable connection for you as he has done for thousands of others since 1909. Inquiries invited; confidences respected.

THE NATIONAL BUSINESS BOURSE, Inc.
Confidential Negotiators
Association Building, Chicago

POSITIONS WANTED

New York

DO YOUR 1922 results satisfy you? I have had fifteen years' experience in the quantity production of sheet metal products. If your problem is along this line of manufacture it will pay you to investigate. Address General Manager, PW-43, Am. Mach., 10th Ave. at 36th St., New York City.

DRAFTSMAN, twenty-five; mechanical designer; seven years' experience; engineering training. PW-30, Am. Mach., 10th Ave. at 36th St., New York City.

EXECUTIVE, age thirty-seven, wide experience in the manufacturing of dies, tools and fixtures, also heavy machinery, desires similar position. PW-28, Am. Mach., 10th Ave. at 36th St., New York City.

WORKS executive; twenty years' experience, starting as a molder in the foundry, working through the machine shop, then becoming superintendent; have handled male and female help for a number of years; available immediately. PW-21, Am. Mach., 10th Ave. at 36th St., New York City.

Ohio

FOREMAN, automatics and hand screw machines; American, thirty-four years of age; ten years setter and foreman of screw machine products; reference furnished upon request. PW-25, Am. Mach., Leader-News Bldg., Cleveland, Ohio.

MASTER mechanic, now employed but would like to change, having twenty years' experience maintainence and construction work, especially qualified for power plants and heavy duty steam and electric cranes; location not essential; execellent references; negotiations confidential. PW-17, Am. Mach., Leader-News Bldg., Cleveland, Ohio.

MAINTENANCE, construction engineer, fifteen years' experience in charge of buildings, machinery, equipment, power.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
509 Real Estate Trust Bldg., Phila.
533 Leader-News Bldg., Cleveland.
1570 Old Colony Bldg., Chicago.
531 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents — send copies.

0195

POSITIONS WANTED

plant layout and plans for buildings, American, age forty-four, married, wishes position with metal or wood working plant; open for position Jan. 1; best of references; any location. PW-45, Am. Mach., Leader-News Bldg., Cleveland, Ohio.

Oklahoma

WANTED—An opportunity to improve following record: $8,400 per year, 40 per cent reduction power costs; $2,000 per year, 50 per cent reduction heating costs. Above is record of works engineer desiring larger opportunities in larger industrial plant. PW-42, Am. Mach., Old Colony Bldg., Chicago, Ill.

Pennsylvania

POSITION as assistant to president or as manager, clean-cut executive, business man and mechanic, with the necessary experience to handle any large proposition. PW-937, Am. Machinist, Real Estate Trust Bldg., Philadelphia, Pa.

SALES work desired by mechanical designer; experienced on tools, special machines and conveyors; age twenty-seven. PW-47, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

SALESMEN WANTED

Machine Tool Salesman Wanted

Preferably man having had experience in handling and operating power presses and shears, also dies. State age, experience and salary expected. Preference given to resident of Cleveland or Detroit. SW-37, Am. Mach., 10th Ave. at 36th St., New York City.

Machine Tool Salesman Wanted

Give experience pertaining to garage equipment; state lines sold, age, past and present firms employed. Address Auto Equipment Co., Denver, Colo.

AGENCIES AVAILABLE

Manufacturer's Agent

Iron, steel and contractor's equipment; established offices in Philadelphia; would like to take on additional line to follow up inquiries or leads and do some missionary work. A-41, Am. Mach., Real Estate Trust Bldg., Philadelphia, Pa.

REPRESENTATION WANTED

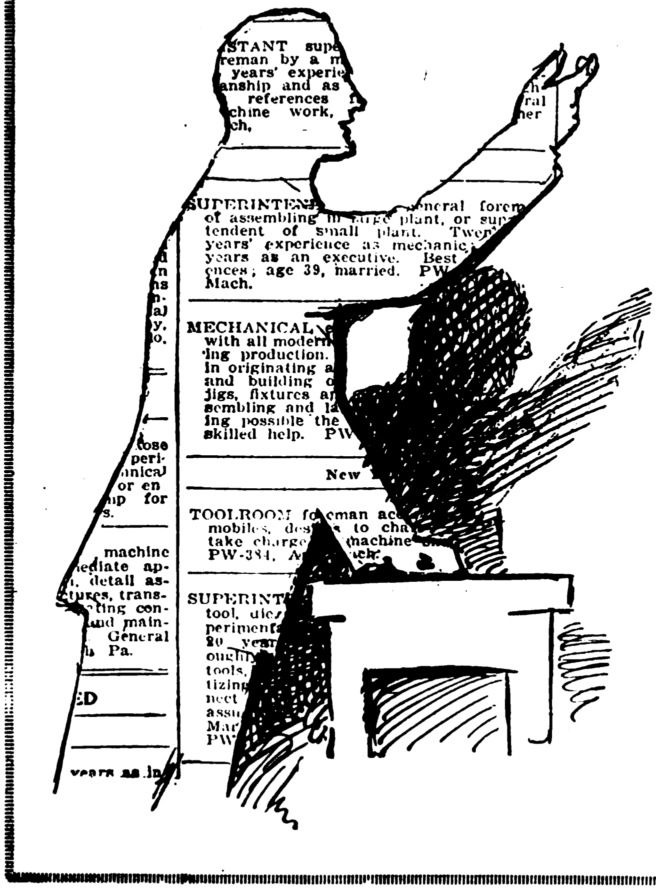
Shop Representative

Wanted in your city to sell K. T. W. taper calipers and clamps. You will find these ready sellers and indispensable tools. Write for prices; generous commission. Knauel Tool Works, 210 5th Ave., Rock Island, Ill.

PATENT ATTORNEYS

PATENTS. C. L. Parker, patent attorney, McGill Bldg., Washington, D. C. Inventor's handbook sent upon request.

PATENTS—Send for form "Evidence of Conception" to be signed and witnessed. Form fee schedule, information, free. Lancaster and Allwine, 262 Ouray Bldg., Washington, D. C.



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WHAT AND WHERE TO BUY
A Classified Index of Advertisers in This Issue
For Alphabetical Index See Last Page

Abrasive Discs
Besly & Co., Chas. H., Chicago
Carborundum Co., Niagara Falls
Gardner Mch. Co., Beloit

Abrasive Materials
Carborundum Co., Niagara Falls
Dickinson, Thos. L., N. Y.
Gardner Mch. Co., Beloit
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield

Accumulators, Hydraulic
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Aftercoolers, Air
Chicago Pneu. Tool Co., N. Y.
Ingersoll-Rand Co., N. Y.

Air Lifts
Sullivan Machinery Co., Chicago.

Air Operated Countershafts
Hannifin Mfg. Co., Chicago

Air Operated Mandrels
Hannifin Mfg. Co., Chicago

Air Operated Vises
Hannifin Mfg. Co., Chicago

Air Receivers
Chicago Pneu. Tool Co., N. Y.

Arbors
Brown & Sharpe Mfg., Co., Providence
Cincinnati (O.) Milling Mach. Co.
Cochrane-Bly Co., Rochester
Cushman Chuck Co., Hartford
National Twist D. & T. Co., Detroit.
Nicholson & Co., W. H., Wilkes-Barre
Standard Eng. Wks., Pawtucket
Union Mfg. Co., New Britain
Union Twist Drill Co., Athol
West Tool Co., Detroit
Whitney Mfg. Co., Hartford

Arbors, Ground Thread
Bath & Co., John, Worcester

Balancing Ways
Anderson Bros. Mfg. Co., Rockford

Ball Retainers
Bearings Co. of America, Lancaster

Balls, Brass, Bronze and Steel
Abbott Ball Co., Hartford
Auburn Ball Bearing Co., Rochester
Strom Steel Ball Co., Oak Park

Barrels, Tumbling
Abbott Ball Co. Hartford
Globe Mch. & Stamp Co., Cleveland
Royersford Fdry. & Mch. Co., Royersford

Bars, Boring
Davis Boring Tool Co., St. Louis
Hannifin Mfg. Co., Chicago
Marvin & Casler Co., Canastota
Underwood Corp., H. B., Phila.

Bars, Bronze Cored
Bunting Brass & Bronze Co., Toledo
Gisholt Mach. Co., Madison

Bearings, Ball
Aetna Ball Bearing Co., Chicago
Auburn Ball Bearing Co., Rochester
Bearings Co. of America, Lancaster
Boston Gear Wks., Norfolk Downs
Fafnir Bearing Co., New Britain
Norma Co. of America, N. Y.
R. I. V. Co., N. Y City
Schatz Mfg. Co, Poughkeepsie

Bearings, Bronze
Bunting Brass & Bronze Co., Toledo
Doehler Die Cast. Co., Brooklyn

Bearings, Die-Cast
Doehler Die Cast. Co., Brooklyn
Franklin Die Cast. Corp., Syracuse
Light Mfg. & Fdry. Co., Pottstown

Bearings, Journal
Bunting Brass & Bronze Co., Toledo
Columbus Brass Co., Columbus

Bearings, Roller
Norma Co. of America, N. Y.
Royersford Fdry. & Mch. Co., Royersford

Belt Cement
Schieren Co., Chas. A., N. Y.

Belt Clamps
Hoggson & Pettis Mfg. Co., New Haven

Belt Dressings and Fillers
Schieren Co., Chas. A., N. Y.
White & Bagley Co., Worcester

Belt Fasteners
Bristol Co., Waterbury

Belt Lacing
Schieren Co., Chas. A., N. Y.

Belt Shifters
LeBlond Mach. Tool Co., R. K., Cincinnati

Belt Tighteners
Jones Fdry. & Mch. Co., W. A. Chicago

Belting, Chain
Link-Belt Co., Chicago, Philadelphia
Morse Chain Co., Ithaca
Whitney Mfg. Co., Hartford

Belting, Endless
Brown Mfg. Co., Arthur S. Tilton

Belting, Leather
Schieren Co., Chas. A., N. Y.

Bench Legs
Brown & Sharpe Mfg. Co., Providence
Manufacturing Equip. & Mfg. Co., Framingham

Benches, Work
Manufacturing Equip. & Mfg. Co., Framingham

Bending Machines Power
Ryerson & Son, Jos. T., Chicago

Blocks
Simplex Tool Co., Woonsocket

Blocks, Chain (See Hoists, Hand)

Blocks, Pillow
Jones Fdry. & Mch. Co., W. A. Chicago

Blowers
American Gas Furnace Co., Elizabeth
Buffalo Forge Co., Buffalo
Chicago Flexible Shaft Co., Chicago
General Electric Co., Schenectady

Blue Print Paper
N. Y. Blue Print Paper Co., N. Y.

Blue Printing Machinery
N. Y. Blue Print Paper Co., N. Y.

Bolt & Nut Machinery
Acme Mchy. Co., Cleveland
Anderson Die Mch. Co., Bridgeport
Foote-Burt Co., Cleveland
Greenfield Tap & Die Corp., Greenfield
Landis Machine Co., Waynesboro
National Machinery Co., Tiffin
Pawtucket Mfg. Co., Pawtucket
Universal Mch. Co., Bowling Green
Victor Tool Co., Waynesboro

Bolt Threading Machinery
Williams Tool Corp., Erie

Bone for Case Hardening
Rogers & Hubbard Co., Middletown

Books, Technical
McGraw-Hill Book Co., N. Y.

Boosters
General Electric Co., Schenectady

Boring Bars, Expansion
Davis Boring Tool Co., St. Louis

Boring and Turning Mills, Vertical
Betts Mch. Plant Cons. Mch. T. Corp. of America, Rochester
Bullard Mach. Tool Co., Bridgeport
Cincinnati Planer Co., Cincinnati
Gisholt Mach. Co., Madison
Newton Mch. T. Plant Cons. Mch. T. Corp. of America, Phila.
Sellers & Co., Wm., Philadelphia

Boring, Drilling and Milling Machines, Horizontal
Barnes Co., W. F. & John, Rockford
Bausch Mch. T. Co., Springfield, Mass.
Betts Mch. Plant Cons. Mch T. Corp. of America, Rochester
Beaman & Smith Co., Providence
Gisholt Mach. Co., Madison
Landis Tool Co., Waynesboro
Lucas Mach. Tool Co., Cleveland
Moline Tool Co., Moline
Murchey Mch. & T. Co., Detroit
Newton Mch. T. Plant Cons. Mch. T. Corp. of America, Phila.
Pawling & Harnischfeger Co., Milwaukee
Rockford (Ill.) Drilling Mach. Co.
Sellers & Co., Wm., Philadelphia
Springfield (O.) Mach. Tool Co.
Vandyck Churchill Co., N. Y.

Boring, Drilling and Milling Mach., Vertical
Betts Mch. Plant Cons. Mch T. Corp. of America, Rochester
Knight Mchy. Co., W. B., St. Louis
Pawling & Harnischfeger Co., Milwaukee

Boring Heads
Davis Boring Tool Co., St. Louis
Lovejoy Tool Co., Springfield, Vt.
Marvin & Casler Co., Canastota

Boring Tools
Armstrong Bros. Tool Co., Chicago
Brown & Sharpe Mfg., Co., Providence
Davis Boring Tool Co., St. Louis
Hannifin Mfg. Co., Chicago
Haynes Stellite Co., Kokomo
Lovejoy Tool Co., Springfield, Vt.
Williams & Co., J. H., Brooklyn

Boxes, Tote (See Furniture, Machine Shop)

Broaches
Hurlbut Rogers Broach. Co., Hudson
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson

Broaching Machines
Lapointe Co., J. N., New London
Lapointe Mach. Tool Co., Hudson
Paramount Specialty T. Co., Waltham
Pawtucket Mfg. Co., Pawtucket

Bronze
Bunting Brass & Bronze Co., Toledo
Brown & Sharpe Mfg., Co., Providence

Bronze, Phosphor
Bunting Brass & Bronze Co., Toledo

Bucket Carriers, Pivoted
Link-Belt Co., Chicago, Philadelphia

Buffing or Polishing Machines (See Polishing and Buffing Machines)

Bulldozers
Toledo Mach. & Tool Co., Toledo

Burners, Oil and Gas
Advance Furnace & Eng. Co., Springfield, Mass.
Best Furnace & Burner Co., W. N., N. Y.
Johnson Gas Appliance Co., Cedar Rapids

Bushings
Bunting Brass & Bronze Co., Toledo
Columbus Brass Co., Columbus
Sterling Specialty Co., Newcomerstown

Cabinets, Tool
Armstrong Bros. Tool Co., Chicago

Calipers
Athol Mach. & Fdry. Co., Athol
Randall & Stickney, Waltham
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol

Cam Cutting Machines
Garvin Machine Co., N. Y.
Rowbottom Mach. Co., Waterbury
Walcott Lathe Co., Jackson

Cams
Rowbottom Mach. Co., Waterbury

Can-Making Machinery (See Sheet Metal Working Machinery)

Carbonizing Machines
American Gas Furnace Co., Elizabeth

Castings, Aluminum
Bunting Brass & Bronze Co., Toledo
Doehler Die Cast. Co., Brooklyn
Grey Mfg. Co., C. M., E. Orange
Light Mfg. & Fdry. Co., Pottstown

Castings, Brass and Bronze
Accurate Brass Casting Co., Brooklyn
Bunting Brass & Bronze Co., Toledo
Columbus Brass Co., Columbus
Doehler Die Cast. Co., Brooklyn
Light Mfg. & Fdry. Co., Pottstown

Castings, Die Molded
Doehler Die Cast. Co., Brooklyn
Franklin Die Cast. Corp., Syracuse
Light Mfg. & Fdry. Co., Pottstown

Castings, Iron
Athol Mach. & Fdry. Co., Athol
Brown & Sharpe Mfg., Co., Providence
Chisholm-Moore Mfg. Co., Cleveland
Franklin Mach. Co., Providence
Springfield (O.) Mach. Tool Co.
Whitcomb-Blaisdell Mach. Tool Co., Worcester

Castings, Malleable Iron
Link-Belt Co., Chicago, Philadelphia

Castings, Semi-Steel
Springfield (O.) Mach. Tool Co.

Centering Machines
Pawling & Harnischfeger Co., Milwaukee
Standard Eng. Wks., Pawtucket
Whiton Mch. Co., D. E., New London

Centers, Planer
Cincinnati Planer Co., Cincinnati

Chains (See Sprockets and Chains)

Chains, Driving
Baldwin Chain & Mfg. Co., Worcester
Diamond Chain & Mfg. Co., Indianapolis
Link-Belt Co., Chicago, Philadelphia
Morse Chain Co., Ithaca
Philadelphia Gear Wks., Phila.
Whitney Mfg. Co., Hartford

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Brown & Sharpe Mfg., Co., Providence
Bullard Mach. Tool Co., Bridgeport
Cleveland (O.) Auto Mach. Co.
Gisholt Mach. Co., Madison
Jones & Lamson Mach. Co., Springfield, Vt.
Potter & Johnston Mch. Co., Pawtucket
Warner & Swasey Co., Cleveland

Chucks, Air
Frontier Chuck & Tool Co., Buffalo
Hannifin Mfg. Co., Chicago

Chucks, Centering
Cushman Chuck Co., Hartford

Chucks, Drill and Tap
Almond Mfg. Co., T. R., Ashburnham
Cushman Chuck Co., Hartford.
Horton & Son Co., E., Windsor Locks
Jacobs Mfg. Co., Hartford
Marvin & Casler Co., Canastota
Morse Twist D. & M. Co., New Bedford.
National Twist D. & T. Co., Detroit
Skinner Chuck Co., New Britain
Union Mfg. Co., New Britain.
Victor Tool Co., Waynesboro.
Whitney Mfg. Co., Hartford.
Whiton Mch. Co., D. E., New London

Chucks, Lathe
Almond Mfg. Co., T. R., Ashburnham
Bullard Mach. Tool Co., Bridgeport.
Cushman Chuck Co., Hartford.
Gisholt Mach. Co., Madison
Hoggson & Pettis Mfg. Co., New Haven
Horton & Son Co., E., Windsor Locks.
Simplex Tool Co., Woonsocket.
Skinner Chuck Co., New Britain
Union Mfg. Co., New Britain.
Whiton Mch. Co., D. E., New London

Chucks, Magnetic
Heald Mach. Co., Worcester

Chucks, Planer
Cincinnati Planer Co., Cincinnati.
Hoggson & Pettis Mfg. Co., New Haven.
Horton & Son Co., E., Windsor Locks.
Skinner Chuck Co., New Britain
Union Mfg. Co., New Britain.

Chucks, Quick Changing
American Equipment Co, Detroit
Geometric Tool Co., New Haven

Chucks, Split
Ames Co., B. C., Waltham.
Rivett Lathe & Grinder Co., Boston.
Stark Tool Co., Waltham
Wade-American Tool Co., Waltham

Chucks, Vertical Boring Mill
Bullard Mach. Tool Co., Bridgeport
Gisholt Mach. Co., Madison

Clamps, Machinists'
Armstrong Bros. Tool Co., Chicago.
Reed Mfg. Co., Erie.
Starrett Co., L. S., Athol.
Williams & Co., J. H., Brooklyn.

Cleaners, Metal, Waste, General
Oakley Chemical Co., N. Y.

Clocks, Time
Gisholt Mach. Co., Madison

Clutches, Friction
Brown Co., A. & F., N. Y.
Brown Eng. Co., Reading
Johnson Mach Co., Carlyle, Manchester.
Jones Fdry. & Mch. Co., W. A. Chicago
Link-Belt Co., Chicago, Philadelphia
Moore & White Co., Philadelphia

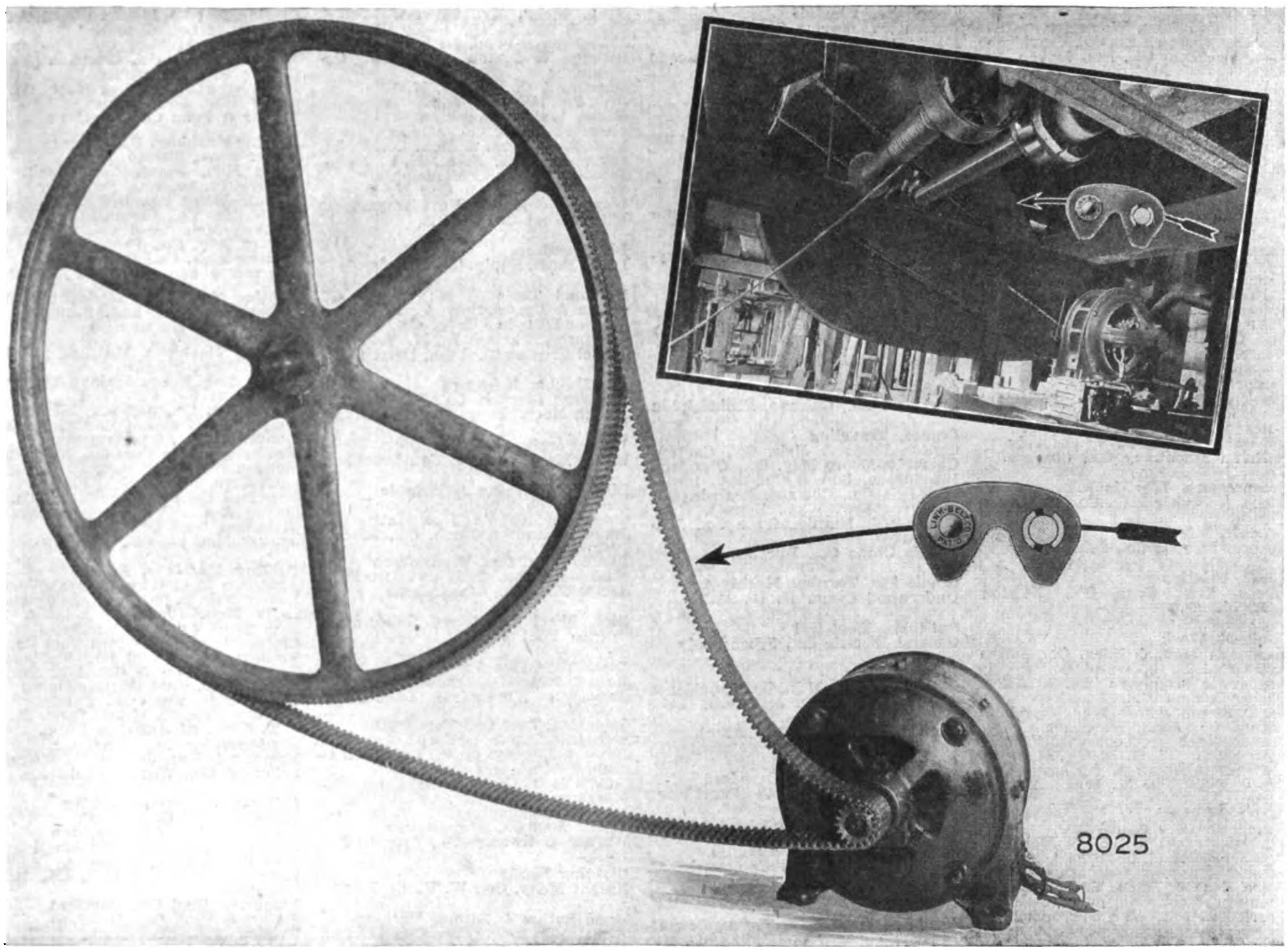
Coal and Ash Handling Machinery
Link-Belt Co., Chicago, Philadelphia

Coal Storage Systems
Link-Belt Co., Chicago, Philadelphia

Coils, Electric
General Electric Co., Schenectady

Collars, Shaft & Set
Royersford Fdry. & Mch. Co., Royersford

Collars, Spacing
Detroit Stamping Co., Detroit.



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Texas Co., N. Y.

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Sun Co., Philadelphia.
White & Bagley Co., Worcester.

Compressors, Air and Gas
Black & Decker Mfg. Co., Baltimore
Bury Compressor Co., Erie.
Chicago Pneu. Tool Co., N. Y.
General Electric Co., Schenectady
Sullivan Machinery Co., Chicago.

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Black & Decker Mfg. Co., Baltimore

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General Electric Co., Schenectady

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Evans Fric. Cone Co., Newton Highlands.

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Bath & Co., John, Worcester
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Columbus (O.) Die T. & Mch. Co.
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Sexton Mach. Co., Hartford
Simplex Tool Co., Woonsocket.
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Warner & Swasey Co., Cleveland.
West Tool Co., Detroit

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General Electric Co., Schenectady

Converters
General Electric Co., Schenectady

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West Tool Co., Detroit

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Garvin Mach. Co., N. Y.

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Bristol Co., Waterbury.

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Counting Machines
Hart Mfg. Co., R. A., Battle Creek

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Doehler Die Casting Co., Brooklyn.
Franklin Die Cast. Corp., Syracuse.

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Chicago Pneu. Tool Co., N. Y.

Couplings, Flexible
Brown Engineering Co., Reading
Dexter Co., I. H., Goshen
Jones Fdry. & Mch. Co., W. A. Chicago
Smith & Serrell, Newark

Couplings, Rigid
Smith & Serrell, Newark.
Jones Fdry. & Mch. Co., W. A. Chicago

Couplings, Shaft
Almond Mfg. Co., T. R., Ashburnham
Dexter Co., I. H., Goshen
Johnson Mach. Co., Carlyle, Manchester.
Nicholson Co., W. H., Wilkes-Barre
Royersford Fdry. & Mch. Co., Royersford
Smith & Serrell, Newark.

Cranes, Electric (See Hoists and Cranes, Electric)

Cranes, Hand (See Hoists)

Cranes, Locomotive
Link-Belt Co., Chicago, Philadelphia

Cranes, Traveling
Canton Fdry. & Mch. Co., Canton.
Chisholm-Moore Mfg. Co., Cleveland
Harrington, Son & Co., Ed., Phila.
Link-Belt Co., Chicago, Philadelphia
Northern Eng. Wks., Detroit.
Pawling & Harnischfeger Co., Milwaukee
Toledo Crane Co., Bucyrus

Crank Pin Turning Machines
Underwood Corp., H. B., Phila.

Cut-Outs, Electrical
General Electric Co., Schenectady

Cutters, Gear
Brown & Sharpe Mfg., Co., Providence
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol.

Cutters, Milling
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Cowles Tool Co., Cleveland
Geometric Tool Co., New Haven
Gisholt Mach. Co., Madison
Haynes Stellite Co., Kokomo
Ingersoll Mill. Mch. Co., Rockford
Lovejoy Tool Co., Springfield, Vt.
Morse Twist Drill & Mch. Co., New Bedford.
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Reed-Prentice Co., Worcester
Union Twist Drill Co., Athol.
West Tool Co., Detroit
Whitney Mfg. Co., Hartford.

Cutters, Thread
Rivett Lathe & Grinder Co., Boston.
Universal Mch. Co., Bowling Green

Cutting-Off Machines
Armstrong-Blum Mfg. Co., Chicago.
Armstrong Bros. Tool Co., Chicago.
Brown & Sharpe Mfg. Co., Providence
Earle Gear & Mach. Co., Phila.
Etna Mach. Co., Toledo
Garvin Mach. Co., N. Y.
Gorton Mach. Co., Geo., Racine.
Greenfield Tap & Die Corp., Greenfield
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Vandyck Churchill Co., N. Y.

Cutting-Off Machines, Pipe (See Pipe-Cutting and Threading Machines)

Cutting-Off Tools
Armstrong Bros. Tool Co., Chicago.
Pratt & Whitney Co., Hartford
Williams & Co., J. H., Brooklyn

Cutting Oil Filters (See Oil Filtering Systems)

Cutting, Oxy Acetylene
Milburn Co., Alex., Baltimore

Dealers, Machinery (See Searchlight Section)
Allen, Harry F., New York
Botwinik Bros., New Haven
Brownell Mch. Co., Providence
Consolidated Mch. T. Corp. of America, N. Y.
Froiland, Paul Springfield, Ill.
Garvin Mch. Co., N. Y.
Gelb & Co., J., N. Y.
Gisholt Mach. Co., Madison
Gordon & Freedman, N. Y.
Gould & Eberhardt, Newark
Harris Bros. Co., Chicago
Hill, Clarke & Co., Chicago.
Hyman & Sons, Jos., Philadelphia
Ideal Mchy. Co., Plainsville
Lamberg & Co., A., N. Y.
Lucas & Son, J. L., Bridgeport
McMullen Mchy. Co., Grand Rapids
Machinery Dealers, Inc., New Haven
Miles Mchy. Co., Saginaw
Morey & Co., N. Y.
Morris Mchy. Co., Newark
New Britain Mach. Co., New Britain
N. J. Mchy. Ex., Newark
Niles & Co., F. H., Jersey City
Niles-Bement-Pond, N. Y.
Osborne & Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Reed-Prentice Co., Worcester
Silber, Walter, Brooklyn
Simmons Mach. Co., Albany
Southwark Fdry. & Mch. Co., Phila.
Stokvis & Sons, R. S., N. Y.
Toomey, Frank, Philadelphia
Vandyck, Churchill Co., N. Y.
Wayne Mchy. Co., Fort Wayne.
Witbar Tool Co., N. Y.

Demagnetizers
Luma Elect. Equip. Co., Toledo

Diamond Tools
Crafts & Co., Arthur A., Boston.
Desmond-Stephan Mfg. Co., Urbana
Dickinson, Thomas L., N. Y.
Wheel Trueing Tool Co., Detroit

Die Making Machines
Anderson Die Cch. Co., Bridgeport
Keller Mech. Engr. Co., Brooklyn

Dies, Forging
Keller Mech. Engrav. Co., Brooklyn.

Dies, Self-opening Adjustable
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mchy. & T. Co., Detroit
Victor Tool Co., Waynesboro

Dies, Sheet Metal and Sub-Press (See Tool Work)

Dies, Threading-Opening
Eastern Mch. Screw Corp., New Haven
Errington Mechanical Laboratory, N. Y.
Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield
Jones & Lamson Mach. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro
Murchey Mchy. & T. Co., Detroit
National Machinery Co., Tiffin.
Victor Tool Co., Waynesboro
Warner & Swasey Co., Cleveland.

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Armstrong Bros. Tool Co., Chicago
Williams & Co., J. H., Brooklyn

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N. Y. Blue Print Paper Co., N. Y.

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N. Y. Blue Print Paper Co., N. Y.

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Bay State Stamping Co., Worcester
Crafts & Co., Arthur A., Boston
Desmond-Stephan Mfg. Co., Urbana
Norton Co., Worcester

Drill Holders
Armstrong Bros. Tool Co., Chicago

Drill Speeders
Graham Mfg. Co., Providence
Turner Machine Co., Danbury

Drilling Attachments
Hjorth Lathe & Tool Co., Boston

Drilling Machine Heads
Baush Mch. T. Co., Springfield, Mass.
Hoefer Mfg. Co., Freeport.
Langelier Mfg. Co., Cranston
Nelson-Blanck Mfg. Co., Detroit.

Drilling Machines, Automatic
Baker Bros., Toledo
Baush Mch. T. Co., Springfield, Mass.
Langelier Mfg. Co., Cranston
Nat'l Automatic Tool Co., Richmond

Drilling Machines, Bench
Ames Co., B. C., Waltham
Barnes Co., W. F. & John, Rockford
Clark Jr. Elec., Co., Jas., Louisville
Hoefer Mfg. Co., Freeport
Langelier Mfg. Co., Cranston
Pratt & Whitney Co., Hartford
Sigourney Tool Co., Hartford
Silver Mfg. Co., Salem
Standard Elec. Tool Co., Cincinnati
Taylor & Fenn Co., Hartford.

Drilling Machines, Electric and Pneumatic
Black & Decker Mfg. Co., Baltimore
Chicago Pneumatic Tool Co., N. Y.
Clark Jr. Elec., Co., Jas., Louisville
Louisville Elec. Mfg. Co., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Silver Mfg. Co., Salem
Standard Elec. T. Co., Cincinnati
U. S. Elec. Tool Co., Cincinnati

Drilling, Machines, Gang
Baker Bros., Toledo
Barnes Drill Co., Rockford
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Langelier Mfg. Co., Cranston
Moline Tool Co., Moline
Rockford (Ill.) Drilling Mach. Co.
Silver Mfg. Co., Salem
Taylor & Fenn Co., Hartford

Drilling Machines, Heavy Duty
Baker Bros., Toledo
Betts Mch. Plant, Cons. Mch. T. Corp. of America, Rochester
Buffalo Forge Co., Buffalo
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Hoefer Mfg. Co., Freeport
Minster Mch. Co., Minster
Ryerson & Son, Joseph T., Chicago

Drilling Machine & Horizontal (See Boring, Drilling and Milling Machines, Horizontal)

Drilling Machines, Multiple Spindle
Baker Bros., Toledo
Baush Mch. T. Co., Springfield, Mass.
Foote-Burt Co., Cleveland
Fox Mach. Co., Jackson, Mich.
Harrington, Son & Co., Ed., Phila.
Langelier Mfg. Co., Cranston
Nat'l Automatic Tool Co., Richmond
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Rockford (Ill.) Drilling Mach. Co.
Sellers & Co., Wm., Philadelphia
Sigourney Tool Co., Hartford
Turner Machine Co., Danbury

Drilling Machines, Radial
American Tool Wks. Co., Cincinnati
Baush Mch. T. Co., Springfield, Mass.
Betts Mch. Plant Cons. Mch. T. Corp. of America, Rochester
Cincinnati (O.) Bickford Tool Co.
Fosdick Mach. Tool Co., Cincinnati
Harrington, Son & Co., Ed., Phila.
Morris Mch. Tool Co., Cincinnati
Muller Mch. Tool Co., Cincinnati
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia

Drilling Machines, Sensitive
Buffalo Forge Co., Buffalo
Langelier Mfg. Co., Cranston
Muehlmatt, Adolph, Cincinnati
Reed-Prentice Co., Worcester
Royersford Fdry. & Mch. Co., Royersford
Sigourney Tool Co., Hartford
Taylor & Fenn Co., Hartford
Triplex Mch. Tool Corp., N. Y.

Drilling Machines, Turret
Nat'l Automatic Tool Co., Richmond
Turner Mch. Co., Danbury

Drilling Machines, Vertical
Baker Bros., Toledo
Barnes Drill Co., Rockford
Barnes Co., W. F. & John, Rockford
Baush Mch. T. Co., Springfield, Mass.
Betts Mch. Plant Cons. Mch. T. Corp. of America, Rochester
Cincinnati (O.) Bickford Tool Co.
Foote-Burt Co., Cleveland
Fosdick Mch. Tool Co., Cincinnati
Harrington, Son & Co., Ed., Phila.
Hoefer Mfg. Co., Freeport
Knight Mchy. Co., W. B., St. Louis
Langelier Mfg. Co., Cranston
Leland-Gifford Co., Worcester
Reed-Prentice Co., Worcester
Royersford Fdry. & Mach. Co., Royersford
Ryerson & Son, Jos. T., Chicago
Silver Mfg. Co., Salem
Taylor & Fenn Co., Hartford
Turner Mch. Co., Danbury

Drills, Center
Gledhill Mfg. Co., Providence
Morse Twist D. & M. Co., New Bedford
National Twist D & T. Co., Detroit
Pratt & Whitney Co., Hartford
Slocomb Co., J. T., Providence
Union Twist Drill Co., Athol

Drills, Ratchet
Armstrong Bros. Tool Co., Chicago
National Twist D. & T. Co., Detroit
Union Twist Drill Co., Athol

Drills, Twist and Flat
Buckeye Twist Drill Co., Alliance
Latrobe Tool Co., Latrobe
Morse Twist D. & M. Co., New Bedford
National Twist D. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Union Twist Drill Co., Athol
West Tool Co., Detroit
Whitman & Barnes Mfg. Co., Akron

Drinking Fountains
Manufacturing Equip. & Eng. Co., Framingham

Dynamometers
General Electric Co., Schenectady

Electrical Instruments
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Electrical Supplies
General Electric Co., Schenectady
Simplex Wire & Cable Co., Boston
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Elevating Trucks (See Trucks)

Elevators and Conveyors
Albro-Clem Elevator Co., Phila.
Caldwell & Son Co., H. W., Chicago
Dillon Elect. Co., Canton
Link-Belt Co., Chicago, Philadelphia

Emery Wheels (See Grinding Wheels)

Engineers, Industrial and Mechanical
Bath & Co., John, Worcester
Hartford Special Mchy. Co., Hartford
Underwood Corp., H. B., Philadelphia

Engines, Oil, Gas and Steam
Chicago Pneu. Tool Co., N. Y.

Engraving Machinery
Gorton Mach. Co., Geo., Racine
Keller Mech. Engr. Co., Brooklyn
Preis Co., H. P., Columbus

Expanders, Tube
Watson-Stillman Co., N. Y.

Eyeglass, Safety (See Goggles, Safety)

Fans, Electric
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans, Exhaust
General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Fans, Ventilating
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

File Handles
Parker Supply Co., N. Y.

Files
American Swiss File & Tool, N. Y.

Files and Rasps
Delta File Works, Philadelphia

Filing Machines
Ames Co., B. C., Waltham
Cochrane-Bly Co., Rochester
Oliver Instrument Co., Adrian
Wardwell Mfg. Co., Cleveland

Filler, Iron (See Cement, Iron)

Fittings, Hydraulic
Burroughs Co., Newark
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Flexible Shafts
Errington Mehanical Laboratory, N. Y.
Strand & Co., N.A., Chicago

Forging Machinery
Acme Mchry. Co., Cleveland
Bradley & Son, C. C., Syracuse
National Mchy. Co., Tiffin

Forgings, Drop
Bearings Co. of America, Lancaster
Universal Mch. Co., Bowling Green
Williams & Co., J. H., Brooklyn

Foundry Equipment
Adams Co., Dubuque

Fuel Oil Burning System
Advance Furnace & Eng. Co., Springfield, Mass.
Chicago Flexible Shaft Co., Chicago

Furnaces, Forging
American Gas Furnace Co., Elizabeth
Chicago Flexible Shaft Co., Chicago

Furnaces, Heat-Treating, Coal
American Industrial Furnace Corp., Boston

Furnaces, Heat-Treating Oil and Gas
Advance Furnace & Eng. Co., Springfield, Mass.
American Gas Furnace Co., Elizabeth
American Industrial Furnace Corp., Boston
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
Johnson Gas Appliance Co., Cedar Rapids

Furnaces, Tempering and Annealing
Advance Furnace & Eng. Co., Springfield, Mass.
American Gas Furnace Co., Elizabeth
Brown & Sharpe Mfg. Co., Providence
Chicago Flexible Shaft Co., Chicago
General Electric Co., Schenectady
Johnson Gas Appliance Co., Cedar Rapids

Furnaces & Ovens
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

Furniture, Machine Shop
Brown Eng. Co., Reading
Manufacturing Equip. & Mfg. Co., Framingham

Gage Blocks
Bath & Co., John, Worcester
Pratt & Whitney Co., Hartford

Gages, Comparator
Jones & Lamson Mach. Co., Springfield, Vt.

Gages, Dial
Ames Co., B. C., Waltham
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham
Starrett Co., L. S., Athol

Gages, Micrometer Plug
Bath & Co., John, Worcester

Gages Micrometer Threaded Plug
Bath & Co., John, Worcester

Gages, Plug & Ring
Bath & Co., John, Worcester

Gages, Recording
Bristol Co., Waterbury

Gages, Snap, Thread and Cylindrical
Brown & Sharpe Mfg. Co., Providence
Greenfield Tap & Die Corp., Greenfield
Pratt & Whitney Co., Hartford

Gages, Standard
Brown & Sharpe Mfg. Co., Providence
Greenfield Tap & Die Corp., Greenfield
Hartford Special Mchy. Co., Hartford
Pratt & Whitney Co., Hartford

Gages, Thread
Bath & Co., John, Worcester

Gear Cutting Machines
Adams Co., Dubuque
Barber-Colman Co., Rockford
Bilgram Mch. Wks., Philadelphia
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Cut. Mch. Co.
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
Garvin Mch. Co., N. Y.
Gleason Works, Rochester
Gould & Eberhardt, Newark
Harrington, Son & Co., Ed., Phila.
Newark Gear Cutting Mch. Co., Newark
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Reed-Prentice Co., Worcester
Waltham Mch. Wks., Waltham
Whiton Mch. Co., D. E., New London

Gear Tempering Machinery
Gleason Works, Rochester

Gear Testing Machinery
Adams Co., Dubuque
Brown & Sharpe Mfg. Co., Providence
Gisholt Mach. Co., Madison
Gleason Works, Rochester
Newark Gear Cut Mch. Co., Newark

Gear Tooth Rounders
Cross Gear & Eng. Co., Detroit

Gears, Cast
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Caldwell & Son Co., H. W., Chicago
Franklin Die Cast Corp., Syracuse
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland
Jones Fdry. & Mch. Co., W. A. Chicago
Link-Belt Co., Chicago, Philadelphia
Philadelphia Gear Wks., Phila.

Gears, Cut
Adams Co., Dubuque
Albaugh-Dover Co., Chicago
Albro-Clem Elevator Co., Phila.
Baush Mch. T. Co., Springfield, Mass.
Bilgram Mch. Wks., Philadelphia
Boston Gear Wks., Norfolk Downs
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Gear Co.
Connecticut Gears, Inc., Waterbury
Diefendorf Gear Corp., Syracuse
Earle Gear & Machine Co., Phila.
Fawcus Mch. Co., Pittsburgh
Fellows Gear Shaper Co., Springfield, Vt.
Flather & Co., Nashua
Foote Bros. Gear & Mch. Co., Chicago
Garvin Mch. Co., N. Y.
General Electric Co., Schenectady
Gleason Works, Rochester
Grant Gear Works, Boston
Horsburgh & Scott Co., Cleveland
Jones Fdy. & Mch. Co., W. A., Chicago
Link-Belt Co., Chicago, Philadelphia
Massachusetts Gear & T. Co., Woburn
Meacham Gear Corp., Syracuse
Meisel Press Mfg. Co., Boston
Newark Gear Cutting Mch. Co., Newark
Niles-Bement-Pond Co., N. Y.
Philadelphia Gear Wks., Phila.
Simonds Mfg. Co., Pittsburgh

Gears, Forged
Philadelphia Gear Wks., Phila.

Generators, Electric
Reliance Elect. & Eng. Co., Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Grab Buckets
Link-Belt Co., Chicago, Philadelphia
Toledo Crane Co., Bucyrus

Greases, Lubricating
Royersford Fdry. & Mch. Co., Royersford
Sun Co., Philadelphia
White & Bagley Co., Worcester

Grinding Machines, Ball Bearing Race (See Grinding Machines, Radial)

Grinding Machines, Bench
Athol Machine & Fdry. Co., Athol
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Clark Jr. Elec. Co., Jas., Louisville
Dillon Elect. Co., Canton
Greenfield Tap & Die Corp., Greenfield
Louisville Elect. Mfg. Co., Louisville
Marschke Mfg. Co., Indianapolis
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Ryerson & Son, Jos. T., Chicago
Safety Emery Wheel Co., Springfield, O.
Standard Elect T. Co., Cincinnati
Union Twist Drill Co., Athol
U. S. Elec Tool Co., Cincinnati

Grinding Machines, Center
Louisville Elect. Mfg. Co., Louisville
Standard Elect. T. Co., Cincinnati

Grinding Machine Centerless
Reeves Pulley Co., Columbus

Grinding Machines, Chaser
Geometric Tool Co., New Haven

Grinding Machines, Chucking
Blanchard Mch. Co., Cambridge
Bryant Chuck Grind. Co., Springfield, Vt.
Heald Machine Co., Worcester
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Stow Mfg. Co., Binghamton
Van Norman Mch. Co., Springfield, Mass.

Grinding Machines, Cutter and Reamer
Armstrong Bros. Tool Co., Chicago
Barber-Colman Co., Rockford
Barnes Co., W. F. & John, Rockford
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Gear Cut. Mach. Co.
Cincinnati (O) Milling Mach. Co.
Garvin Mach. Co., N. Y.
Gisholt Mach. Co., Madison
Grand Rapids (Mich.) Grind. Mach. Co.
Greenfield Tap & Die Corp., Greenfield
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
LeBlond Mch. Tool Co., R. K., Cincinnati
Norton Co., Worcester
Pratt & Whitney Co., Hartford
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadlphia
Sterling Grind. Wheel Co., Tiffin
Taylor & Fenn Co., Hartford
Union Twist Drill Co., Athol
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Cylindrical
Brown & Sharpe Mfg. Co., Providence
Bryant Chuck Grind Co., Springfield Vt.
Cincinnati (O.) Grinder Co.
Fitchburg Grind. Mch. Co., Fitchburg
Heald Mach. Co., Worcester
Landis Tool Co., Waynesboro
Norton Co., Worcester
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Sanford Mfg. Co., F. C., Bridgeport
Universal Grind. Mch. Co., Fitchburg
Van Norman Mch. Tool Co., Springfield, Mass.
Whitney & Son, Baxter D., Winchendon

Grinding Machines, Die
Abrasive Mch. T. Co., Providence
Bignall & Keeler Mch. Wks., Edwardsville
Blanchard Mach. Co., Cambridge
Geometric Tool Co., New Haven
Heald Mch. Co., Worcester
Murchey Mch. & T. Co., Detroit
National Mchy. Co., Tiffin
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Disc
Besley & Co., Chas. H., Chicago
Gardner Mch. Co., Beloit
Graham Mfg. Co., Providence
Rowbottom Mach. Co., Waterbury
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Drill
Grand Rapids (Mich.) Grind. Mach. Co.
Greenfield Tap & Die Corp., Greenfield
Louisville Elec. Mfg. Co., Louisville
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Wm., Philadelphia
Sterling Grind. Wheel Co., Tiffin

Grinding Machines, Face
Abrasive Mch. T. Co., Providence
Blanchard Mach. Co., Cambridge
Graham Mfg. Co., Providence

Grinding Machines, Floor
Blount Co., J. G., Everett
Brown & Sharpe Mfg. Co., Providence
Dillon Elect. Co., Canton
Forbes & Myers, Worcester
Louisville Elect. Mfg. Co., Louisville
Marschke Mfg. Co., Indianapolis
Norton Co., Worcester
Ransom Mfg. Co., Oshkosh
Royersford Fdry. & Mch. Co., Royersford
Ryerson & Son, Jos. T., Chicago
Sterling Grind. Wheel Co., Tiffin
U. S. Elect. Tool Co., Cincinnati

Grinding Machines, Gage
Abrasive Mch. T. Co., Providence
Landis Tool Co., Waynesboro
Rivett & Morman Co., Grand Rapids
Universal Grind. Mch. Co., Fitchburg

Grinding Machines, Internal
Bryant Chuck Grind Co., Springfield Vt.
Cincinnati (O.) Grinder Co.
Garvin Mach. Co., N. Y.
Greenfield Tap & Die Corp., Greenfield
Heald Machine Co., Worcester
Landis Tool Co., Waynesboro
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Universal Grind. Mch. Co., Fitchburg
Van Norman Mch. Tool Co., Springfield, Mass
Whitney & Son, Baxter D., Winchendon

Grinding Machines, Portable
Armstrong-Blum Mfg. Co., Chicago
Black & Decker Mfg. Co., Baltimore
Chicago Pneu. Tool Co., N. Y.
Clark Jr. Elec. Co., Jas., Louisville
Dillon Elect. Co., Canton
Forbes & Myers, Worcester
Hergi Mfg. Co., Bridgeport
Louisville Elec. Mfg. Co., Louisville
Neil & Smith Elec. T. Co., Cincinnati
Stroud, Arva, N. Y.
U. S. Elec. Tool Co., Cincinnati

Grinding Machines, Radial
Landis Tool Co., Waynesboro
Rivett Lathe & Grind. Co., Boston
Van Norman Mch. Tool Co., Springfield, Mass.

Grinding Machines, Ring Wheel
Besley & Co., Chas. H., Chicago
Graham Mfg. Co., Providence
Gardner Mch. Co., Beloit

Grinding Machines, Snagging
Blount Co., J. G., Everett
Dillon Elect. Co.
Ransom Mfg. Co., Oshkosh
U.S. Elect. Tool Co., Cincinnati

Grinding Machines, Surface
Abrasive Mch. T. Co., Providence
Blanchard Mch. Co., Cambridge
Brown & Sharpe Mfg. Co., Providence
Graham Mfg. Co., Providence
Heald Mach. Co., Worcester
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Norton Co., Worcester
Pratt & Whitney Co., Hartford
Rowbottom Mach. Co., Waterbury
Safety Emery Wheel Co., Springfield, O.

Grinding Machines, Thread
Bath & Co., John, Worcester

Grinding Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Chicago Pneu. Tool Co., N. Y.
Cincinnati (O.) Grinder Co.
Gisholt Mach. Co., Madison
Grand Rapids (Mich.) Grind. Mach. Co.
Greenfield Tap & Die Corp., Greenfield
Landis Tool Co., Waynesboro.
Norton Co., Worcester.
Wilmarth & Morman Co., Grand Rapids.

Grinding Wheels.
Carborundum Co., Niagara Falls
Dickinson, Thomas L., N. Y.
Norton Co., Worcester
Safety Emery Wheel Co., Springfield, O.
Sterling Grind. Wheel Co., Tiffin.
Vitrified Wheel Co., Westfield.

Guides, Elevator
Standard Gauge Steel Co., Beaver Falls

Gun Barrel Machinery
Baush Mch. T. Co., Springfield, Mass
Pratt & Whitney Co., Hartford

Hammers, Drop
Bradley & Son, C. C., Syracuse

Hammers, Forging
Nazel Eng. & Mch. Wks., Phila.

Hammers, Pneumatic
Chicago Pneu. Tool Co., N. Y.

Hammers, Power
Bliss Co., C. W., Brooklyn
Bradley & Son, C. C., Syracuse
Nazel Eng. & Mch. Wks., Phila.
Ryerson & Son, Joseph T., Chicago.

Handles, Machine
Rockwood Sprinkler Co., Worcester.

Hangers, Shafting
Armstrong Bros. Tool Co., Chicago.
Brown & Sharpe Mfg. Co., Providence
Jones Fdry. & Mch. Co., W. A. Chicago
Royersford Fdry. & Mch. Co., Royersford

Hardening, Case Hardening & Tempering
Meisel Press Mfg. Co., Boston

Hardness Testing Apparatus
Shore Instrument & Mfg. Co., N. Y.

Heaters, Electric Water
Bridgeport Mach. & Tool Mfg. Co., Bridgeport

Hobbing Machines
Barber-Colman Co., Rockford
Cincinnati (O.) Gear Cutting Mch.
Gould & Eberhardt, Newark
Newark Gear Cut Mch. Co., Newark

Hobs
Barber-Colman Co., Rockford
Brown & Sharpe Mfg. Co., Providence
Greenfield Tap & Die Corp., Greenfield
Newark Gear Cut Mch. Co., Newark
Philadelphia Gear Wks., Phila.
Union Twist Drill Co., Athol.

Hoists and Cranes, Electric
Link-Belt Co., Chicago, Philadelphia
Northern Engineering Wks., Detroit.
Pawling & Harnischfeger Co., Milwaukee
Toledo Crane Co., Bucyrus.

Hoists, Hand
Canton Fdry. & Mch. Co., Canton.
Chisholm-Moore Mfg. Co., Cleveland
Ford Chain Block & Mfg. Co. Philadelphia.
Harrington, Son & Co., Ed., Phila.

Hoists, Pneumatic.
Chicago Pneu Tool Co., N. Y.
Sullivan Mchy. Co., Chicago

Holders-On, Pneumatic
Chicago Pneu. Tool Co., N. Y.

Hydraulic Leather
Schieren Co., Chas. A., N. Y.

Hydraulic Machinery
Watson-Stillman Co., N. Y.

Igniters, Gas Engine
Doehler Die Casting Co., Brooklyn

Indicators, Speed and Test
Brown & Sharpe Mfg. Co., Providence
Marvin & Casler Co., Canastota
Starrett Co., L. S. Athol.

Jacks, Hydraulic
Watson-Stillman Co., N. Y.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago.

Jigs and Fixtures (See Contract Work)

Kettles, Soda
Brown & Sharpe Mfg. Co., Providence
Gray & Prior Mch. Co., Hartford.

Keyseating Machines
Baker Bros., Toledo
Lapointe Mach. Tool Co., Hudson.
Lapointe Co., J. N., New London.
Mitts & Merrill, Saginaw.
Morton Mfg. Co., Muskegon Heights
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.

Keys, Machine
Morton Mfg. Co., Muskegon Heights
Moltrup Steel Products Co., Beaver Falls
Whitney Mfg. Co., Hartford.

Knurl Holders
Williams & Co., J. H., Brooklyn.

Lamps, Electric
General Electric Co., Schenectady

Lathe Attachments
Ames Co., B. C., Waltham.
Dalton Mfg. Corp., Sound Beach
Flather & Co., Nashua
Rivett Lathe & Grinder Co., Boston.
Walcott Lathe Co., Jackson

Lathe Tools
Armstrong Bros. Tool Co., Chicago.
Gisholt Mach. Co., Madison.
Haynes Stellite Co., Kokomo
Lovejoy Tool Co., Springfield, Vt.
Williams & Co., J. H., Brooklyn.

Lathes, Automatic and Semi-Automatic
Gisholt Mach. Co., Madison.
Jones & Lamson Mch. Co., Springfield, Vt.
Potter & Johnston Mch. Co., Pawtucket.
Reed-Prentice Co., Worcester.
Steinle Turret Mch. Co., Madison

Lathes, Bench
Ames Co., B. C. Waltham.
Blount Co., J. G., Everett.
Dalton Mfg. Corp., Sound Beach
Greenfield Tap & Die Corp., Greenfield
Hjorth Lathe & Tool Co., Boston.
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston.
South Bend Lathe Wks., South Bend
Stark Tool Co., Waltham.
Triplex Mch. Tool Corp., N. Y.
Van Norman Mch. Tool Co., Springfield, Mass.
Wade-American Tool Co., Waltham

Lathes, Boring
Gisholt Mach. Co., Madison.
Potter & Johnston Mch. Co., Pawtucket.

Lathes, Chucking (See Lathes, Horizontal Turrett)

Lathes, Engine
American Tool Wks. Co., Cincinnati
Barnes Co., W. F. & John, Rockford
Barnes Drill Co., Rockford.
Blount Co., J. G., Everett.
Bradford Mch. Tool Co., Cincinnati.
Carroll-Jamieson Mch. T. Co., Batavia
Champion Tool Wks. Co., Cincinnati
Dalton Mfg. Corp., Sound Beach
Fitchburg Mach. Wks., Fitchburg.
Flather & Co., Nashua.
Gisholt Mach. Co., Madison.
Greaves Klusman T. Co., Cincinnati
Hamilton Mch. T. Co., Hamilton
LeBlond Mch. Tool Co., R. K., Cincinnati.
Lodge & Shipley Mch. T. Co., Cincinnati.
Monarch Mach. Tool Co., Sydney.
Morris Mch. Tool Co., Cincinnati
Mueller Mch. Tool Co., Cincinnati
Reed-Prentice Co., Worcester
Rockford (Ill.) Drilling Mach. Co.
Rockford (Ill.) Tool Co.
Ryerson, Joseph T., Chicago.
Sidney Mch. T. Co., Sidney
South Bend Lathe Wks., South Bend
Springfield (O.) Mach. Tool Co.
Walcott Lathe Co., Jackson
Whitcomb-Blaisdell Mch. T. Co., Worcester.

Lathes, Extension and Gap
American Tool Wks. Co., Cincinnati
Barnes Drill Co., Rockford.
Harrington, Son & Co., Ed., Phila.

Lathes, Foot Power
Barnes Co., W. F. & John, Rockford
Dalton Mfg. Corp., Sound Beach

Lathes, Gap
Carroll Mch. T. Co., A. V., Norwood

Lathes, Horizontal Turret
Acme Mach. Tool Co., Cincinnati.
Foster Mach. Co., Elkhart.
Gisholt Mach. Co., Madison.
Internat. Mch. T. Co., Indianapolis
Jones & Lamson Mch. Co., Springfield, Vt.
Millholland Mch. Co., Indianapolis
Pratt & Whitney Co., Hartford
Reed-Prentice Co., Worcester.
Steinle Turret Mch. Co., Madison.
Warner & Swasey Co., Cleveland.

Lathes, Polishing (See Polishing and Buffing Machines)

Lathes, Speed and Hand
Blount Co., J. G., Everett.
Brown & Sharpe Mfg. Co., Providence
Garvin Machine Co., N. Y.
Greenfield Tap & Die Corp., Greenfield

Lathes, Threading
Automatic Mach. Co., Bridgeport.
Rivett Lathe & Grinder Co., Boston

Lathes, Vertical
Bullard Mch. Tool Co., Bridgeport

Lathes, Wood Turning
Barnes Co., W. F. & John, Rockford
Blount Co., J. G. Everett.

Letters and Figures
Brown & Sharpe Mfg. Co., Providence
Hoggson & Pettis Mfg. Co., New Haven.
Pannier Bros. Stamp Co., Pittsburgh

Lighting Fixtures
General Electric Co., Schenectady

Lockers, Clothes
Manufacturing Equip. & Mfg. Co., Framingham

Lubricants
Oakley Chemical Co., N. Y.
Royersford Fdry. & Mch. Co., Royersford
Sun Co., Philadelphia
White & Bagley Co., Worcester.

Machinists' Small Tools
Armstrong Bros. Tool Co., Chicago.
Athol Machine & Fdry. Co., Athol
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney Co., Hartford
Randall & Stickney, Waltham
Simplex Tool Co., Woonsocket.
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol.
Williams & Co., J. H., Brooklyn

Mandrels, Expanding
Bath & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
Nicholson & Co., W. H., Wilkes-Barre

Mandrels, Solid
Brown & Sharpe Mfg. Co., Providence
National Twist D. & T. Co., Detroit
Nicholson & Co., W. H., Wilkes-Barre
Union Twist Drill Co., Athol

Marking Devices (See Stamps, Steel)

Marking Machines
Luma Elect. Equip. Co., Toledo
Martin Mch. Co., Turners Falls
Noble & Westbrook Mfg. Co., Hartford.

Measuring Machines
Norma Co. of America, N. Y.
Pratt & Whitney Co., Hartford

Meters, Steam Flow
General Electric Co., Schenectady

Micrometer Calipers
Almond Mfg. Co., T. R., Ashburnham
Brown & Sharpe Mfg. Co., Providence
Randall & Stickney, Waltham
Slocomb Co., J. T., Providence
Starrett Co., L. S., Athol.

Milling Attachments
Adams Co., Dubuque
Bath & Co., John, Worcester
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Garvin Mach. Co., N. Y.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee
LeBlond Mch. Tool Co., R. K., Cincinnati.
Potter & Johnston Mch. Co., Pawtucket.
Reed-Prentice Co., Worcester
Standard Eng. Wks., Pawtucket.

Milling Machines, Automatic
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Ingersoll Mill Mch. Co., Rockford
Pratt & Whitney Co., Hartford

Milling Machines, Bench
Ames Co., B. C., Waltham.
Pratt & Whitney Co., Hartford
Stark Tool Co., Waltham
Triplex Mch. Tool Corp., N. Y.
Van Norman Mch. Tool Co., Springfield, Mass.

Milling Machine, Continuous
Ingersoll Mill. Mch. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Potter & Johnston, Mch. Co., Pawtucket.

Milling Machines Die
Anderson Die Mch. Co., Bridgeport

Milling Machines, Duplex
Cincinnati (O) Milling Mach. Co.
Ingersol Mill Mch. Co., Rockford
Knight Mchy. Co., W. B., St. Louis
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.

Milling Machines, Hand
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Fox Machine Co., Jackson, Mich.
Garvin Mch. Co., N. Y.
Pratt & Whitney Co., Hartford
Reed-Prentice Co., Worcester
Standard Eng. Co., Pawtucket
Van Norman Mch. T. Co., Springfield, Mass.
Whitney Mfg. Co., Hartford.

Milling Machines, Horizontal and Planer Type
Beaman & Smith Co., Providence.
Betts Mch. Plant Cons. Mch. T. Corp. of America, Rochester
Ingersoll Mill Mch. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.

Milling Machines, Plain
Betts Mch. Plant Cons. Mch. T. Corp. of America, Rochester
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Fox Machine Co., Jackson, Mich.
Garvin Machine Co., N. Y.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee
LeBlond Mch. Tool Co., R. K., Cincinnati.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Potter & Johnston Mch. Co. Pawtucket.
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Standard Eng. Wks., Pawtucket.
Van Norman Mch. T. Co., Springfield, Mass.

Milling Machines, Portable
Ingersoll Mill Mch. Co., Rockford
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Underwood Corp., H. B., Phila.

Milling Machines, Thread
Foster Mch. Co., Elkhart.
Gisholt Mach. Co., Madison
Hall Planetary Thread Milling Mch. Co., Philadelphia
Harrington Son & Co., Ed., Phila.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Pratt & Whitney Co., Hartford
Waltham Mch. Works, Waltham.

Milling Machines, Universal
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Fox Machine Co., Jackson, Mich.
Garvin Mch. Co., N. Y.
Ingersoll Mill Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee
LeBlond Mch. Tool Co., R. K., Cincinnati.
Potter & Johnston Mch. Co., Pawtucket.
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Van Norman Mch. T. Co., Springfield, Mass.

Milling Machines, Vertical
Betts Mch. Plant Cons. Mch. T. Corp. of America, Rochester
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O) Milling Mach. Co.
Garvin Machine Co., N. Y.
Ingersoll Mill. Mch. Co., Rockford
Kearney & Trecker Co., Milwaukee.
Knight Mchy. Co., W. B., St. Louis
LeBlond Mch. Tool Co., R. K., Cincinnati.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Potter & Johnston Mch. Co., Pawtucket.
Reed-Prentice Co., Worcester
Triplex Mch. Tool Corp., N. Y.
Van Norman Mch. T. Co., Springfield, Mass.

Milling Machines, Worm
Cleveland (O.) Auto. Mch. Co
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Waltham Mch. Works, Waltham.

Milling Tools, Adjustable Hollow
Geometric Tool Co., New Haven

Motors, Electric
Burke Electric Co., Erie
Reliance Elect. & Eng Co., Cleveland
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

Nickel Sheets
Strand & Co., N. A., Chicago

Nut Tappers (See Bolt and Nut Machinery)

Nuts, Lock (See Lock-Nuts)

Oil and Grease Cups
Bay State Stamp. Co., Worcester.
Bowen Products Corp., Auburn
Gits Bros. Mfg. Co., Chicago.
Tucker, W. A. & C. F., Hartford.

Oil Stones
Norton Co., Worcester

Oils
Sun Co., Philadelphia
White & Bagley Co., Worcester.

Oxygen
Linde Air Products Co., N. Y.

Packing, Hydraulic
Schieren Co., Chas. A., N. Y.

Pattern Shop Machinery (See Woodwork Machinery)

Patterns, Wood and Metal
Mehl Mch. T. & D. Co., Roselle.

Pipe Bending Machines
Harrington Son & Co., Ed., Phila.
Underwood Corp., H. B., Phila.

Pipe Cutting & Threading Machines
Bignall & Keeler Mch. Wks., Edwardsville.
Fox Mch. Co., Jackson, Mich.
Greenfield Tap & Die Corp., Greenfield
Harrington, Son & Co., Ed., Phila.
Landis Mch. Co., Waynesboro.
Murchey Mch. & T. Co., Detroit
Saunders Sons, D., Yonkers.
Williams Tool Corp., Erie

Pipe Fitters' Tools
Butterfield & Co., Derby Line.
Ryerson & Son, Jos. T., Chicago
Williams & Co., J. H., Brooklyn.

Piston Ring Machines
Potter & Johnston Mch. Co., Pawtucket

Planer Tools
Haynes Stellite Co., Kokomo

Planing Machines
American Tool Wks Co., Cincinnati
Betts Mch. Plant Cons. Mch. T. Corp. of America, Rochester
Cincinnati Planer Co., Cincinnati.
Gray Co., G. A., Cincinnati.
Hamilton Mch. T. Co., Hamilton
Liberty Mch. T. Co., Hamilton
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Reed-Prentice Co., Worcester
Ryerson & Son, Joseph T., Chicago
Sellers & Co., Wm., Philadelphia.

Planing Machines, Rotary
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Underwood Corp., H. B., Phila.

Pneumatic Tools
Anderson Bros. Mfg. Co., Rockford
Chicago Pneu. Tool Co., N. Y.

Polishing and Buffing Machines
Barnes Co., W. F. & John, Rockford
Blanchard Mch. Co., Cambridge.
Blount Co., J. G., Everett.
Brown & Sharpe Mfg.Co., Providence
Bryant Chuck Grind Co., Springfield Vt.
Gardner Mch. Co., Beloit
Greenfield Tap & Die Corp., Greenfield
Heald Mch. Co., Worcester.
Landis Tool Co., Waynesboro.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Rivett Lathe & Grinder Co., Boston
Rowbottom Mach. Co., Waterbury.
Royersford Fdry. & Mch. Co., Royersford
Safety Emery Wheel Co., Springfield, O.
Union Twist Drill Co., Athol.
Van Norman Mch. Tool Co., Springfield, Mass.

Presses, Arbor
Barnes Co., W. F. & John, Rockford
Nicholson & Co., W. H., Wilkes-Barre

Presses, Drop and Forging
Ams Mch. Co., Max, N. Y.
Bliss Co., E. W., Brooklyn.
Elmes Eng. Wks., Chas. F., Chicago
Toledo Mch. & Tool Co., Toledo.

Presses, Foot and Hand
Bliss Co., E. W., Brooklyn.
Ferracute Mach. Co., Bridgeton.
Shuster Co., F. B., New Haven
Taylor & Fenn Co., Hartford.

Presses, Forcing
Ams Mch. Co., Max, N. Y.
Barnes Co., W. F. & John, Rockford
Lucas Mch Tool Co., Cleveland.

Presses, Hydraulic
Burroughs Co., Newark
Elmes Eng. Wks., Chas. F., Chicago
U. S. Tool Co., Newark
Watson-Stillman Co., N. Y.

Presses, Power
Ams Mch. Co., Max, N. Y.
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton.
Loy & Nawrath Division Birmingham Iron Fdry., Derby
Rowbottom Mch. Co., Waterbury.
Stoll Co., D. H., Buffalo.
Toledo Mch. & Tool Co., Toledo.
U. S. Tool Co., Newark
V & O Press Co., Glendale, L. I.

Presses, Screw
Barnes Co., W. F. & John, Rockford
Bliss Co., E. W., Brooklyn.

Profiling Machines
Becker Milling Mch. Co., Worcester
Garvin Machine Co., N. Y.
Pratt & Whitney Co., Hartford
Stark Tool Co., Waltham
Wade-American Tool Co., Waltham

Pulley Turning and Boring Machines
American Tool Wks. Co., Cincinnati.

Pulleys, Cork Insert
American Pulley Co., Philadelphia.

Pulleys, Metal
American Pulley Co., Philadelphia.
Brown Co., A. & F., N. Y.
Brown & Sharpe Mfg.Co., Providence
Caldwell & Son Co, H. W., Chicago.
Johnson Mach. Co., Carlyle, Manchester.

Pumps, Hydraulic
Burroughs Co., Newark
Elmes Eng. Wks., Chas. F., Chicago

Pumps, Lubricant and Oil
Brown & Sharpe Mfg.Co., Providence

Pumps, Power
Sullivan Mchy. Co., Chicago

Punches, Center
Brown & Sharpe Mfg.Co., Providence
Starrett Co., L. S., Athol.

Punches, Hand
Armstrong-Blum Mfg. Co., Chicago.

Punches, Power
Buffalo Forge Co., Buffalo
Ferracute Mach. Co., Bridgeton.
Mitts & Merrill, Saginaw
Royersford Fdry. & Mch. Co., Royersford
Ryerson & Son, Joseph T., Chicago
Watson-Stillman Co., N. Y.

Pyrometers, Electric
Bristol Co., Waterbury.

Rack Cutting Machines
Newark Gear Cut Mch. Co., Newark

Rack, Machine
Standard Gauge Steel Co., Beaver Falls

Racks, Cut
Meisel Press Mfg. Co., Boston
Moltrup Steel Products Co. Beaver Falls

Racks, Storage (See Furniture, Machine Shop)

Rammers, Foundry
Brown & Sharpe Mfg.Co., Providence
Chicago Pneu. Tool Co., N. Y.

Rawhide, Rope
Schieren Co., Chas. A., N. Y.

Reamer Holders
Gisholt Mach. Co., Madison
Victor Tool Co., Waynesboro

Reamers, Adjustable
Davis Boring Tool Co., St. Louis
Hannifin Mfg. Co., Chicago

Reamers, Expanding
Brubaker & Bros. Co., W. L., N. Y.
Davis Boring Tool Co., St. Louis
Gisholt Mach. Co. Madison
Greenfield Tap & Die Corp., Greenfield

Reamers, Solid
Brubaker & Bros. Co., W. L., N. Y.
Buckeye Twist Drill Co., Alliance
Butterfield & Co, Derby Line.
Gammon-Holman Co., Manchester
Greenfield Tap & Die Corp., Greenfield
Morse Twist D. & M. Co., New Bedford.
National Twist D. & T. Co., Detroit
Reed Mfg. Co., Erie.
Union Twist Drill Co., Athol.
Whitman & Barnes Mfg. Co., Akron

Reamers, Taper
Brown & Sharpe Mfg.Co., Providence
Gammon-Holman Co., Manchester
Greenfield Tap & Die Corp., Greenfield
Union Twist Drill Co., Athol

Recorders, Pressure
Bristol Co., Waterbury.

Recorders, Temperature
Bristol Co., Waterbury.

Recorders, Time
Gisholt Mach. Co., Madison

Rheostats
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

Rivet Heating
American Gas Furnace Co., Elizabeth

Rivet Sets
Chicago Pneu. Tool Co., N. Y.
Hunter Saw & Machine Co., Pittsburgh

Rivet Making Machinery
Cook Co., Asa S., Hartford.
National Machinery Co., Tiffin.
Ryerson & Son, Jos. T., Chicago

Riveting Machines
Chicago Pneu. Tool Co., N. Y.
Grant Mfg. & Mch. Co., Bridgeport
Independent Pneu. T. Co., Chicago
Shuster Co., F. B., New Haven.
Townsend Mfg. Co., H. P., Hartford

Rod Cutters
Tucker, W. A. & C. F., Hartford.

Rules, Steel and Wood
Brown & Sharpe Mfg.Co., Providence
Starrett Co., L. S., Athol.

Rust Preventives
Oakley Chemical Co., N. Y.

Sand Rammers, Pneumatic
Chicago Pneu. Tool Co., N. Y.

Saw Frames and Blades, Hack
American Saw & Mfg. Co., Springfield, Mass.
Diamond Saw & Stamp. Wks., Buffalo.
Napier Saw Wks., Springfield, Mass.
Starrett Co., L. S., Athol.

Saw Sharpening Machines
Greenfield Tap & Die Corp., Greenfield
Hunter Saw & Mch. Co., Pittsburgh
Wardwell Mfg. Co., Cleveland

Saw Tables, Universal
Silver Mfg. Co., Salem

Sawing Machines, Metal
Armstrong-Blum Mfg. Co., Chicago
Diamond Saw & Stamp. Wks., Buffalo.
Earle Gear & Mach. Co., Phila.
Greenfield Tap & Die Corp., Greenfield
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Peerless Mach. Co., Racine
Vandyck Churchill Co., N. Y.

Sawing Machines, Power Hack
Armstrong-Blum Mfg. Co., Chicago
Diamond Saw & Stamp. Wks., Buffalo.
Peerless Mach. Co., Racine

Saws, Metal Cutting
American Saw & Mfg. Co., Springfield, Mass.
Barber-Colman Co., Rockford
Brown & Sharpe Mfg.Co., Providence
Hunter Saw & Mach. Co., Pittsburgh
Pratt & Whitney Co., Hartford
Silver Mfg. Co., Salem
Union Twist Drill Co., Athol.

Saws, Milling
Barber-Colman Co., Rockford
Brown & Sharpe Mfg.Co., Providence
Union Twist Drill Co., Athol

Saws, Screw Slotting
Barber-Colman Co., Rockford
Brown & Sharpe Mfg.Co., Providence
Pratt & Whitney Co., Hartford
Starrett Co., L. S., Athol, Mass.
Union Twist Drill Co., Athol.

Scales
Brown & Sharpe Mfg.Co., Providence

Scraping Outfits
Hergi Mfg. Co., Bridgeport

Screw Driving Outfits
Hergi Mfg. Co., Bridgeport

Screw-Machine Work
Cincinnati (O.) Automatic Mch. Co.
Eastern Mch. Screw Corp., New Haven
Link-Belt Co., Chicago, Philadelphia
Morris Mch. Tool Co., Cincinnati.
National Blank Book Co., Holyoke
Simplex Tool Co., Woonsocket
Taft-Peirce Mfg. Co., Woonsocket.

Screw Machy., Wood and Lag
Cook Co., Asa S., Hartford.
Townsend Mfg. Co., H. P., Hartford

Screw Machines, Automatic
Brown & Sharpe Mfg.Co., Providence
Cincinnati (O.) Automatic Mch. Co.
Cleveland (O.) Automatic Mach. Co.
Cone Auto. Mch. Co., Windsor

Screw Machines, Plain or Hand
Acme Mch. Tool Co., Cincinnati.
Brown & Sharpe Mfg.Co., Providence
Cleveland (O) Auto Mach. Co.
Foster Mach. Co., Elkhart.
Garvin Mach. Co., N. Y.
Greenfield Tap & Die Corp., Greenfield
Jones & Lamson Mch. Co., Springfield, Vt
Millholland Mch. Co., Indianapolis
Warner & Swasey Co., Cleveland.

Screw Plates
Brubaker & Bros. Co., W. L., N. Y.
Butterfield & Co., Derby Line.
Card Mfg. Co., S. W. Mansfield.
Greenfield Tap & Die Corp., Greenfield
Morse Twist D. & M. Co., New Bedford.

Screws, Cap and Set
Allen Mfg. Co., Hartford.
Bristol Co., Waterbury.
National Acme Co., Cleveland.

Screws, Machine
Allen Mfg. Co., Hartford.
Bristol Co., Waterbury.

Seamless Steel Tubing (See Tubing, Seamless Steel)

Second-Hand Machinery (See Searchlight Section)
Allen, Harry F., New York
Botwinik Bros., New Haven
Brownell Mchy. Co., Providence
Cincinnati Planer Co., Cincinnati.
Consolidated Mch. T. Corp. of America, N. Y.
Essley Mchy. Co., E. L., Chicago
Emmerman, Louis E., Chicago
Froiland, Paul Springfield, Ill.
Garvin Machine Co., N. Y.
Gelb & Co., J., N. Y.
Gisholt Mach. Co., Madison
Gordon & Freedman, N. Y.
Gould & Eberhardt, Newark
Harris Bros. Co., Chicago
Hill, Clarke & Co., Chicago.
Hyman & Sons, Jos., Philadelphia
Ideal Mchy. Co., Plainsville
Lamberg & Co., A., N. Y.
Lucas & Son, J. L., Bridgeport
McMullen Mchy. Co., Grand Rapids
Machinery Dealers, Inc., New Haven
Miles Mchy. Co., Saginaw
Morey & Co., N. Y.
Morris Mchy. Co., Newark
New Britain Mach. Co., New Britain
N. J. Mchy. Ex., Newark
Niles & Co., F. H., Jersey City
Niles-Bement-Pond, N. Y.
Osborne & Sexton Mchy. Co., Columbus
Prentiss & Co., Henry, N. Y.
Reed-Prentice Co., Worcester
Silber, Walter, Brooklyn
Simmons Mch. Co., Albany
Southwark Fdry. & Mch. Co., Phila.
Stokvis & Son, R. S., N. Y.
Toomey, Frank, Philadelphia
Vandyck, Churchill Co., N. Y. City
Warner & Swasey Co., Cleveland
Wayne Mchy. Co., Fort Wayne.

Separators, Oil and Waste
Oil & Waste Saving Mch. Co., Phila.

Shafting
Royersford Fdry. & Mch. Co., Royersford
Strand & Co., N. A., Chicago.
Union Drawn S. Co., Beaver Falls

Shapes, Cold-Drawn Special Steel
Standard Gauge Steel Co., Beaver Falls
Moltrup Steel Products Co. Beaver Falls
Union Drawn S. Co., Beaver Falls.

Shaping Machines
American Tool Wks. Co., Cincinnati
Cincinnati Shaper Co., Cincinnati
Gould & Eberhardt, Newark
Kelly Co., R. A., Xenia, O.
Morton Mfg. Co., Muskegon Hgts.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Ohio Mach. T. Co. Co., Kenton
Potter & Johnston Mch. Co., Pawtucket.
Ryerson & Son, Joseph T., Chicago
Smith & Mills Co., Cincinnati.
Springfield (O.) Mach. Tool Co.

Shear Blades
Cleveland (O.) Twist Drill Co.

Shears, Hand
Armstrong-Blum Mfg. Co., Chicago.
Tucker, W. A. & C. F., Hartford.

Shears, Power
Buffalo Forge Co., Buffalo
Ferracute Mach. Co., Bridgeton.
Mitts & Merrill, Saginaw
Royersford Fdry. & Mch. Co., Royersford
Stoll Co., D. H., Buffalo.
Toledo Mch. & Tool Co., Toledo.

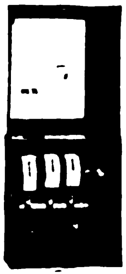
Sheet Metal Working Machinery
Ams Mch. Co., Max, N. Y.
Bliss Co., E. W., Brooklyn
Ferracute Mach. Co., Bridgeton.
Ryerson & Son, Jos. T., Chicago
Savage Co., W. J., Knoxville.
Toledo Mch. & Tool Co., Toledo.

Slide Rests
Milliken Mch. Co., West Newton

Magnetic Starting Switches—for controlling small alternating-current motors thrown directly on the line

Push Button Stations, for actuating G-E Magnetic Switches, may be placed on the machine for convenience in starting and stopping—they are invaluable in emergencies.

G-E CR 7006-D2 Enclosed Magnetic Switch with two-coil hand-reset Temperature Overload Relay. Maximum ratings—10 H.P., 110 and 220 volts; 5 H.P., 440 and 550 volts. 3 and 4 pole.



G-E CR 7006-D3 with Temperature Overload Relay. Maximum ratings—10 H.P., 110 volts; 25 H.P., 220 volts; 35 H.P., 440 and 550 volts. Has magnetic blow-outs. 3 pole only.

G-E CR 7005-A2. Suitable for A.C motors up to 3 H.P., 110 volts; and 5 H.P., 220, 440, or 550 volts. 3 pole only. Equipped with Inverse Time Protective Plugs which are economical and convenient for the protection of motors not frequently overloaded.

Motor control at a touch

This line of G-E Magnetic Starting Switches is the result of leadership constantly maintained in building switches that improve motor operation.

Features of these switches are capacity for service and life of contacts—durable, sheet steel enclosing case—convenience of installation—ease of inspection and renewal of vital parts—compact and pleasing appearance—undervoltage and overload protection.

For protection against overloads these Magnetic Switches are equipped with Inverse Time Protective Plugs—and Temperature Relays which is the latest and most improved design in the field.

Protective Plugs heat practically the same as motors when overloaded, and so protect the motor from dangerous overloads. Temperature Relays afford protection similar to that of the Protective Plugs, but they also provide additional protection according to the increased or decreased horsepower capacity of the motor due to low or high atmospheric temperatures.

Thousands of G-E Magnetic Switches are in successful operation—meeting severe service in many installations.

General Electric Company

General Office Schenectady, N.Y.

Sales Offices in all large cities

43A-94

Slotting Machines
Betts Mch. Plant Cons. Mch. T. T. Corp. of America, Phila.
Newton Mch. T. Plant, Cons. Mch. T. Corp. of America, Phila.
Garvin Mach. Co., N. Y.
Sellers & Co., Wm., Philadelphia

Sockets and Sleeves
Philadelphia Gear Wks., Phila.
Pratt & Whitney Co., Hartford

Soldering Equipment
Luma Elect. Equip. Co., Toledo

Special Machinery and Tools
(See Contract Work)
Cleveland (O.) Twist Drill Co.

Speed Reducers
Jones Fdry. & Mch. Co., W. A. Chicago

Spindles
Ex-Cell-O T. & Mfg. Co., Detroit

Spring Winders
Hjorth Lathe & Tool Co., Boston

Sprockets and Chains
Baldwin Chain & Mfg. Co., Worcester
Bilgram Mch. Wks., Philadelphia.
Boston Gear Wks., Norfolk Downs.
Cullman Wheel Co., Chicago.
Diamond Chain & Mfg. Co., Indianapolis
Grant Gear Wks., Boston.
Jones Fdry. & Mch. Co., W. A. Chicago
Link-Belt Co., Chicago, Philadelphia
Massachusetts Gear & T. Co., Woburn
Morse Chain Co., Ithaca.
Philadelphia Gear Wks., Phila.
Whitney Mfg. Co., Hartford.

Squares
Brown & Sharpe Mfg. Co., Providence
Starrett Co., L. S., Athol.

Stampings, Metal
American Pulley Co., Philadelphia.
Bay State Stamp. Co., Worcester.
Detroit Stamp. Co., Detroit.
Globe Mch. & Stamp Co., Cleveland
National Blank Book Co., Holyoke
Rockwood Sprinkler Co., Worcester

Stamps, Steel
Hoggson & Peters Mfg. Co., New Haven
Noble & Westbrook Mfg. Co., Hartford.
Pannier Bros Steam Co., Pittsburgh
Schwerdtle Stamp Co., Bridgeport

Stands, Portable (See Furniture, Machine Shop)

Steam Specialties
Dart Mfg. Co., E. M., Providence.

Steel, Cold Rolled Strip
Hawkridge Bros. Co., Boston.

Steel Hardness Measuring Instruments
Shore Instrument & Mfg. Co., N. Y.

Steel, Shafting and Free Cutting Screw
Hawkridge Bros. Co., Boston.
Moltrup Steel Products Co., Beaver Falls
Standard Gauge Steel Co., Beaver Falls
Union Drawn S. Co., Beaver Falls.

Steel, Sheet
Hawkridge Bros. Co., Boston.
Jessop & Sons, William, N. Y.
Moltrup Steel Products Co., Beaver Falls

Steels, Alloy, Carbon, and High Speed
Armstrong Bros. Tool Co., Chicago.
Firth-Sterling Steel Co., McKeesport
Hawkridge Bros. Co., Boston.
Haynes Stellite Co., Kokomo
Jessop & Sons, Wm., N. Y.
Jones & Co., B. W., N. Y.
Vanadium Alloys Steel Co., Pittsburgh
Vulcan Crucible Steel Co., Aliquippa

Straightening Machinery
Haynes Stellite Co., Kokomo
Shuster Co., F. B., New Haven.
Springfield (O.) Mach. Tool Co.
Standard Eng. Wks., Pawtucket.

Stud Setters Self-Opening
Errington Mechanical Laboratory N. Y.
Geometric Tool Co., New Haven

Subpresses and Dies
Waltham Mach. Wks., Waltham.

Surface Plates
Simplex Tool Co., Woonsocket.

Swaging Machines
Etna Mach. Co., Toledo
Langelier Mfg. Co., Cranston
Torrington Co., Torrington.

Switches and Switchboards
General Electric Co., Schenectady
Westinghouse Elec. & Mfg. Co., E. Pittsburgh

Tachometers
Bristol Co., Waterbury.

Tap Extensions
Allen Mfg. Co., Hartford.

Tap Holders
Errington Mechanical Laboratory, N. Y.
Gisholt Mach. Co., Madison
Greenfield Tap & Die Corp., Greenfield

Taps, Ground
Bath & Co., John, Worcester

Taper Pins
Brown & Sharpe Mfg. Co., Providence
Pratt & Whitney Co., Hartford

Tapes, Measuring
Starrett Co., L. S., Athol.

Tapping Machines and Attachments
Acme Mchy. Co., Cleveland.
American Tool Wks. Co., Cincinnati
Anderson Die Mch. Co., Bridgeport
Baker Bros., Toledo
Barber-Colman Co., Rockford
Beaman & Smith Co., Providence.
Cincinnati (O.) Bickford Tool Co.
Errington Mechanical Laboratory N. Y.
Fox Mch. Co., Jackson, Mich.
Garvin Mach. Co., N. Y.
Geometric Tool Co., New Haven
Harrington, Son & Co., Ed., Phila.
Hoefer Mfg. Co., Freeport, Ill.
Langelier Mfg. Co., Cranston
Moline Tool Co., Moline.
Murchey Mch. & T. Co., Detroit
Nat'l Automatic T. Co., Richmond
National Mchy. Co., Tiffin.
Taylor Instrument Cos., Rochester
Turner Machine Co., Danbury.

Taps and Dies
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Brubaker & Bros. Co., W. L., N. Y.
Butterfield & Co., Derby Line.
Card Mfg. Co., S. W., Mansfield.
Greenfield Tap & Die Corp., Greenfield
Morse Twist D. & M. Co., New Bedford.
Murchey Mch. & T. Co., Detroit
Pratt & Whitney Co., Hartford

Taps, Collapsing
Eastern Mch. Screw Corp., New Haven
Errington Mechanical Laboratory N. Y.
Geometric Tool Co., New Haven
Murchey Mch. & T. Co., Detroit
Victor Tool Co., Waynesboro.

Thermometers
Bristol Co., Waterbury.

Thread-Cutting Tools
Eastern Mch. Screw Corp., New Haven
Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mach. Co., Waynesboro.
Murchey Mch. & T. Co., Detroit
Pratt & Whitney Co., Hartford
Rivett Lathe & Grinder Co., Boston
Victor Tool Co., Waynesboro

Thread Rolling Machines
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National Machinery Co., Tiffin.

Threading Machines
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Geometric Tool Co., New Haven
Greenfield Tap & Die Corp., Greenfield
Hall Planetary Thread Milling Mch. Co., Philadelphia.
Landis Mach. Co., Waynesboro.
Murchey Mch. & T. Co., Detroit
National Machy. Co., Tiffin.
Universal Mch. Co., Bowling Green

Tool Holders
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Gisholt Mach. Co., Madison
Lovejoy Tool Co., Springfield, Vt.
Pratt & Whitney Co., Hartford
Williams & Co., J. H., Brooklyn.

Tool Marking, Electric
Luma Elect. Equip. Co., Toledo

Tool Posts, Lathe
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Williams & Co., J. H., Brooklyn

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Tools, Small (See Machinists' Small Tools)

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General Electric Co., Schenectady
Westinghouse Elect. & Mfg. Co., E. Pittsburgh

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Foote Bros. Gear & Mch. Co., Chicago
Jones Fdry. & Mch. Co., W. A. Chicago
Moore & White Co., Philadelphia
Morse Chain Co., Ithaca
Royersford Fdry. & Mch. Co., Royersford

Transportation System (See Trucks)

Trolleys and Tramways
Chisholm-Moore Mfg. Co., Cleveland
Harrington, Son & Co., Ed., Phila.

Trucks
Lakewood Eng. Co., Cleveland

Trucks, Industrial
Elwell Parker Elect. Co., Cleveland
Lakewood Eng. Co., Cleveland

Tubing, Flexible
Almond Mfg. Co., T. R., Ashburnham

Turret Heads
Almond Mfg. Co., T. R., Ashburnham
Milliken Mch. Co., West Newton

Turret Machines (See Lathes, Horizontal Turret)

Turrets, Tool Post
American Tool Wks. Co., Cincinnati

Unions, Pipe
Dart Mfg. Co., E. M., Providence.

Universal Joints
Baush Mch. T. Co., Springfield, Mass.
Boston Gear Wks., Norfolk Downs
Dexter Co., I. H., Goshen
Elwell Parker Elect. Co., Cleveland
Gray & Prior Mch. Co., Hartford.
Hartford Special Mchy. Co., Hartford
Standard Eng. Wks., Pawtucket.
Universal Mch. Co., Bowling Green

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Burroughs Co., Newark
Elmes Eng. Wks., Chas. F., Chicago
Watson-Stillman Co., N. Y.

Vises, Drilling Machine
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Armstrong Bros. Tool Co., Chicago.
Barber-Colman Co., Rockford
Brown Eng. Co., Reading
Hartford Special Mchy. Co., Hartford
Hoggson & Pettis Mfg. Co., New Haven

Vises, Metal Workers'
Athol Machine & Fdry. Co., Athol.
Hartford Special Mchy. Co., Hartford
Reed Mfg. Co., Erie.

Vises, Milling Machine
Brown & Sharpe Mfg. Co., Providence
Cincinnati (O.) Milling Mch. Co.
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Reed Mfg. Co., Erie.
Saunders Sons, D., Yonkers.
Williams & Co., J. H., Brooklyn.

Vises, Pipe
Athol Machine & Fdry. Co., Athol.
Butterfield & Co., Derby Line.
Greenfield Tap & Die Corp., Greenfield

Vises, Planer and Shaper
American Tool Wks. Co., Cincinnati
Cincinnati Planer Co., Cincinnati.
Hartford Special Mchy. Co., Hartford
Hoggson & Pettis Mfg. Co., New Haven.

Vises, Universal Machine
Brown & Sharpe Mfg. Co., Providence
Graham Mfg. Co., Providence
Hartford Special Mchy. Co., Hartford
Hoggson & Pettis Mfg. Co., New Haven
Horton & Son Co., E., Windsor Locks
Kempsmith Mfg. Co., Milwaukee
Skinner Chuck Co., New Britain

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Link-Belt Co., Chicago, Philadelphia

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Detroit Stamping Co., Detroit.

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Welding, Oxy-Acetylene (See Welding Machines, Oxy-Acetylene)

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General Electric Co., Schenectady
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Thomson Spot Weld. Co., Lynn.
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Silver Mfg. Co., Salem

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Williams & Co., J. H., Brooklyn.

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